THE
ELECTRICAL REVIEW.

VOL. LXII. MAY 1, 1908. No. 1,588.

ELECTRICAL REVIEW.

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UNSATISFACTORY CONDITIONS OF CONTRACT.

DURING 1903 the Institution of Electrical Engineers issued a form of Model General Conditions, intended to represent terms of contract fair and equitable to both purchaser and seller, and these were approved after prolonged discussion between the leading consulting engineers (as representing the purchasers) and the leading contractors (as representing the sellers).

That these conditions are fair and equitable no one who has studied them can deny. Unfortunately, however, they have not come into so general a use as might be desired; and, although the substance of the conditions is embodied in some of the specifications issued by our leading municipalities and other purchasers, there are still many specifications issued which depart from these conditions in important respects.

It is perhaps too much to expect that the actual form of conditions recommended by the Institution of Electrical Engineers should be adopted by corporations and other public bodies in connection with their contracts, for the simple reason that most corporations already have their standard forms of conditions which are applicable to contracts of a diverse nature, and they would, therefore, resent special forms of conditions being introduced in connection with their electrical contracts.

It is, however, much to be desired that the substance of the conditions recommended by the Institution of Electrical Engineers should, as far as possible, be adopted, and be used in all contracts entered into with electrical contractors, and that many of the unfair conditions at present imposed upon contractors should give way to those which are avowedly equitable to both purchaser and seller.

The clauses in many specifications which are particularly hard upon contractors can usually be limited to five—namely: terms of payment; absence of an arbitration clause; unnecessarily heavy bonds required to be entered into by outside parties on behalf of the contractor; abnormally heavy penalties for lateness in delivery; and, finally, the heavy penalties laid down in the event of the efficiencies being below those guaranteed; the two last-named penalties being often out of all proportion to the value of the contract.

Those conversant with the general conditions of contract prevailing on the Continent will at once acknowledge that even the conditions suggested by the Institution of Electrical Engineers are abnormally severe on the contractor, and it is certain that many of the still severer conditions found in other specifications would be unacceptable to any firm of contractors of repute on the Continent.

To take a single instance, it is customary on the Continent for a portion of the contract price to be paid with the order,

a portion which in most cases is not less than one-third, and in many cases is as high as one-half of the contract price.

The terms laid down in the conditions recommended by the Institution of Electrical Engineers stipulate for 80 per cent. of the value of the contract to be paid on delivery of the material to site; and even in this respect many purchasers in this country consider themselves entitled to defer payment of this 80 per cent. until the plant has been erected and set to work, and in some cases until trivial adjustments—which might reasonably be made during the maintenance period—have been carried out.

Unfortunately, unreasonable conditions of this description impose a great hardship upon the contractor, who is obviously not in so favourable a position for financing the work he is carrying through as a municipality or other public body; and it is certain that conditions bearing hardly upon the contractor are neither in the interests of the trade generally nor of the purchasers themselves.

It is therefore to be hoped that engineers responsible for inviting tenders will seriously consider the adoption of the conditions recommended by the Institution of Electrical Engineers, and will as far as possible assist in imposing equitable terms which, whilst fully safeguarding the interests of those on whose behalf they are acting, will avoid unnecessary hardship being inflicted upon the contractor.

The clauses of the Model General Conditions issued by the Institution of Electrical Engineers can be recommended as equitable to both purchaser and seller.

THE POLITICS, FINANCE, AND USEFUL SPHERE OF RADIO-TELEGRAPHY.

The *Edinburgh Review* for April contains an article on "The Politics of Radio-Telegraphy," Mr. Charles Bright, in the *Westminster Review*, writes on "The Useful Sphere for Radio-Telegraphy," and within the last few days the directors of Marconi's Wireless Telegraph Co. have issued their annual report and balance-sheet. In addition to the business details usual in such documents, the report contains the lectures delivered by Mr. Marconi at the Liverpool Chamber of Commerce on February 24th, and at the Royal Institution on March 13th.

As might be expected, the *Edinburgh Review* article is based mainly upon the report and minutes of the Select Committee of last year, although, in the manner hallowed by the traditions of that venerable and respected publication, other works are cited at the head of the article. These are Dr. Fleming's "Principles of Electric Wave Telegraphy" and Dr. Erskine Murray's "Handbook of Wireless Telegraphy." The author recounts briefly the scientific and commercial history of wireless telegraphy, and touches its politics by reference to the International Conference, originally summoned at the instigation of the German Emperor, which commenced its deliberations on October 22nd, and completed them on November 3rd, 1906, having reached an agreement provisionally binding upon the nationalities represented, including Montenegro, which had the good fortune to be represented by an expert of such thorough knowledge as Mr. Cuthbert Hall. The sacrifice made by the Marconi Co. in thus placing the services of their then managing director at the disposition of the principality has not, perhaps, been sufficiently recognised. Politics are again to the fore when the writer reaches that stage of the history which records the attempt in Parliament to prevent the ratification of the Convention, and the consequent formation of a Select Committee to determine the question. The writer makes some interesting comments on the *personnel* of the Committee and the evidence tendered. "It will be seen," he says, "that, from a party point of view, all the forces were represented in suitable proportions; but an ideal Committee for dealing with a subject of this character would, without doubt, be differently composed, and it is to be regretted that matters of this kind are ever placed at the mercy of party politics." Sir Gilbert Parker is stated to have considered the important question on its merits. "The attitude he took was especially satisfactory in view of his extensive knowledge of Imperial matters, let alone the fact that he is a strong advocate of Imperial Preference rather than a Free Trader." Mr. Gwynn, the Nationalist member for Galway, is also complimented: "He attended every meeting with remarkable assiduity, and certainly did his utmost for the Irish shareholders in the Marconi Co.—as was, indeed, only natural in the circumstances." In spite of this tendency of the Imperialist member to take a national view and of the Nationalist member to do his utmost, not for the nation or for the Marconi shareholders as a whole, but only for the Irish section of them, the author is disappointed with the Committee's work. "The wonder is not so much that the majority arrived at the conclusions they did—in favour of ratifying the Convention—but rather that they should have done so by so bare a majority—or, indeed, that a minority report should ever have been found necessary. We say so in view of the largely preponderating evidence advocating the Convention—unanimous except in the case of the Marconi Co.'s official witnesses, together with Mr. Henniker Heaton. The small majority (one) by which the majority report was carried can, indeed, only be accounted for by the play of party politics on the one hand, or by deep-seated and ignorant prejudice on the other." The article is useful as a brief summary of some of the essential facts, but we think most people will be content to believe that the British representatives on the International Convention reached the proper conclusions, and that the Parliamentary Committee acted quite wisely in ratifying the responsible experts' acts. The additional arguments which the writer adduces in support of the Committee's action may be sound, but seem to be superfluous in view of the accomplished results.

The directors of the Marconi Co. regret the delay in publishing the report and balance-sheet made up to September 30th. The postponement was due, first, to "the complex and delicate situation" in which the company found itself when the Government indicated an intention to ratify the conclusions of the Berlin Conference; and secondly, to the desire of the directors to come before the shareholders with a definite announcement as to the achievement of the anticipated trans-Atlantic service. The results of this service after six months' continuous working are stated to be satisfactory and encouraging and to justify the confidence with which the directors have throughout regarded "the feasibility of

direct wireless communication with America." The demonstration of the feasibility of such communication is of course of less importance to the shareholders of a company than a demonstration of the profitable carrying on of the work. It is stated that a considerable amount of business has already been transacted and this business is daily increasing, but its money value is not given. There is, however, an estimate on certain data which should be carefully considered. "Speeds varying up to 20 words a minute" have been obtained, but "it is expected to attain a speed of 30 words a minute." On the basis of an improved Irish-Canadian service and of the contemplated English-American service, working 12 hours a day at a speed of 20 words a minute at 4d. per word, a net revenue approaching £150,000 per annum is capable of being earned. The maritime business shows substantial progress in regard to the number of ships fitted, the number of words transmitted and the net receipts, which have grown from £13,000 in 1905, and £27,500 in 1906, to practically £38,000 in 1907. One of the important financial subjects for the consideration of the shareholders at yesterday's meeting was the proposal to increase the capital to £750,000 by the creation of 250,000 cumulative 7 per cent. preference shares of £1 each, to pay off the company's engagements to bankers and others, to carry on and extend the business, to complete the long-distance stations, and provide them with the necessary landline facilities, and also to enable the company to deal with the orders already received and likely to be obtained.

Mr. Charles Bright's article in the *Westminster Review* also deals largely with historical and explanatory features, the portion justifying the title being summed up in the statement that "whilst radio-telegraphy has a considerable sphere before it in directions for which a submarine cable is unsuited, the former is not at present a serious competitor with the latter. Its domain lies, indeed, in other directions, though some day it may prove serviceable for the simultaneous dissemination of Imperial news to all quarters of the Empire at low rates." The article is instructive, and covers much of the ground dealt with by the *Edinburgh* article. Both Mr. Bright in the *Westminster* and the anonymous reviewer in the *Edinburgh*, when considering the progress of wireless telegraphy, recall the fact that "Rome was not built in a day," and express such similar views as that "all praise is due to Mr. Marconi for his persevering determination," in the one case, and in the other that "considerable credit is due to Mr. Marconi's perseverance and business capacity."

The politics of radio-telegraphy in its international relations are settled. They are settled in a way which is contrary generally to the views and the claims which the Marconi Co. has put forward. It is a hopeful sign for the company that the directors realise the futility of standing out against the world, and are prepared "to modify the policy hitherto pursued." The relations of finance to the useful sphere are obviously close. Radio-telegraphy as a scientific pursuit is not exactly the same thing as radio-telegraphy undertaken as a commercial enterprise. In the first, it may be permissible to indulge freely in speculative anticipation. In the second, it is preferable that investment should follow the most promising lines. From the quotations which we have given from the directors' report, it can be seen that from the maritime business there accrues a substantial and increasing income, whilst regarding the Anglo-American service the directors give an estimate which may be realised or may be simply a sum in arithmetic. We have on previous occasions remarked upon the field available to wireless telegraphy which cannot be touched by other methods, and have commented upon the extraordinary anxiety of the company to entrench upon a service which is efficiently performed by others. Circumstances have necessitated the directors altering their policy in one direction. Would it not be wise to consider the advisability of altering their policy in another direction? By confining their expenditure to, and conserving their energies for, maritime and other work in which wireless telegraphy has necessarily a monopoly of the field, it would seem to be possible to give the shareholders something more substantial than the hopes and anticipations which have so far formed the barren crop of the long-distance policy.

Cheap Lighting, Commercially Considered.

Although the pros and cons of the metallic filament lamp in its various forms have frequently formed a theme for discussion during the past two years, it has remained for Messrs. Handcock & Dykes, by the reading of their paper before the Institution, on "Electric Supply Prospects and Charges as Affected by Metallic Filament Lamps and Electric Heating," to elicit a really comprehensive expression of opinion as to the commercial merits and demerits of the lamps. One can hardly controvert the view that the smaller purely residential suppliers will be seriously affected financially, if any large proportion of their consumers embrace the opportunity to obtain "the same amount of light at one-third the cost" as compared with the older type of lamp. At the same time, one may justly argue that the extremist consumer will be led to extend his installation in directions previously unthought of, while the individual who only requires the "same amount of light" would hardly see the force of adopting more costly lamps, in the first instance, with expensive renewals to follow; so that the situation is not quite so adverse to the supplier as would appear at first sight.

However, the fact remains that some engineers are convinced that they are face to face with a serious question, and one authority, near London, supplying a purely residential district, has issued a circular to local contractors and those concerned, from which we have extracted the following paragraph:—

> Whilst convinced that ultimately the cheapening effected will result in a much extended use of electric lighting, the Committee expect to find that for a time the total current consumption for the district will be reduced, and they therefore desire you, before fitting up any consumer's premises, to give clear notice to the consumer that, for a limited time, there may be a small increase in the charge per unit. It does not by any means follow that the consumer's lighting expenditure will be thereby increased, and as soon as the increased use of the light, which the Council expect to follow the introduction of these economical lamps, justifies it, they will revert to the present price, and, it is hoped, to something even lower, per unit.

As the circular directly refers to the use of metallic filament lamps, and is presumably directed at their users only, one is tempted to ask whether such a discrimination between different types of lamp in, say, a private lighting installation, is allowable under the Electric Lighting Acts.

We do not doubt that there is room to raise the price to a consumer using the more efficient lamps, and still leave a good margin of saving on that consumer's bill, and one must also admit that the various statutory clauses relating to this matter are capable of various interpretations, and do not successfully meet actual supply conditions; but the proposal to penalise the consumer adopting economical apparatus, even if justifiable from the supply authorities' point of view, is rather astonishing at this time of day.

The whole question is fraught with many difficulties, and the lengthy discussion which arose from Messrs. Handcock and Dykes's paper did not elucidate this phase of the problem.

If we may venture an opinion formed at the discussion in question, we should say that the unfortunate supplier of the purely residential district would have to put up with his misfortune and trust to future developments; but the raising of the price to metallic filament lamp users, just because they are using very efficient apparatus, was, we think, hardly entertained.

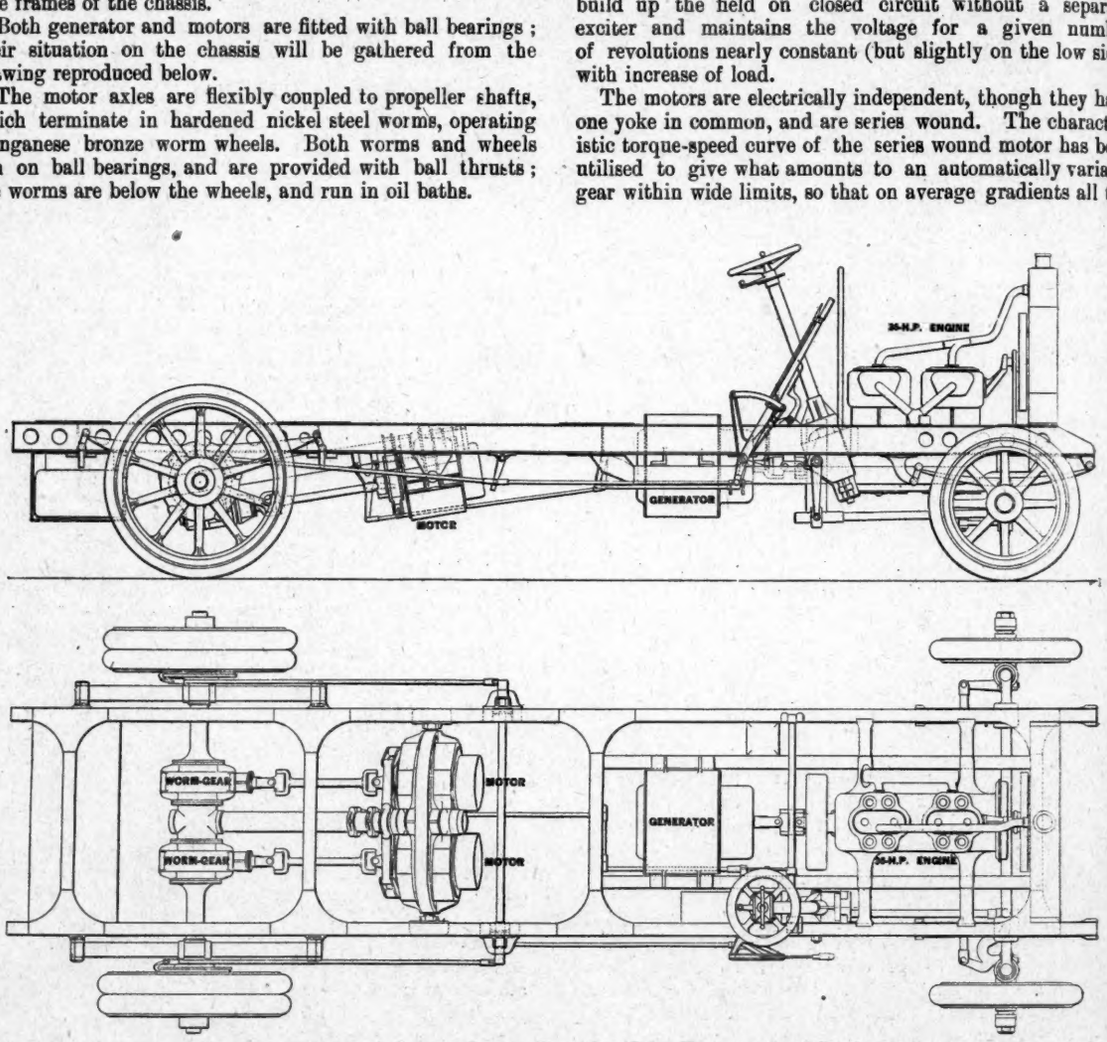
Even if the circular, which is rather indefinite, refers to a raising of prices all round, this would amount to putting a premium on economical apparatus, and it is just possible that an abnormally extended use of the new lamp would speedily ensue, and thus nullify any small advantage which the supply authority might obtain through a small increase in price.

THE GREENWOOD AND BATLEY PETROL-ELECTRIC 'BUS.

We recently had an opportunity of inspecting Messrs. Greenwood & Batley's latest type of petrol-electric omnibus, to which reference has previously been made in these columns. Briefly, the equipment consists of a 36-H.P. Mutel engine driving direct, a protected four-pole compound-wound generator, which in turn supplies energy to two independent series-wound motors mounted between the side frames of the chassis.

Both generator and motors are fitted with ball bearings; their situation on the chassis will be gathered from the drawing reproduced below.

The motor axles are flexibly coupled to propeller shafts, which terminate in hardened nickel steel worms, operating manganese bronze worm wheels. Both worms and wheels run on ball bearings, and are provided with ball thrusts; the worms are below the wheels, and run in oil baths.



The Greenwood and Batley Petrol-Electric 'Bus: Views of the Chassis.

The worm wheels are bolted to internal driving shafts, which rotate inside a tubular rear axle, and drive the road wheels through jaw couplings.

The electrical control is by means of a handle fitted below the steering wheel, coupled to the controller proper at the base of the steering column; this provides a combination of series-parallel and field-control giving four forward speeds and a reverse.

All the electrical cables are carried in rubber and canvas pipes, terminating in water-tight unions at controller, generator and motor.

The engine control is by the usual ignition and throttle levers above the steering wheel (but not turning with it), supplemented by a pedal. External brakes on the motor couplings, operated by the foot, and internally acting brakes on the rear road wheels, operated by hand, are fitted.

Consideration of the following details of the electrical features will make clear the method of working:—

The generator has two separate shunt windings and a series winding. One shunt winding is connected across the generator brushes, and is sufficient to maintain a voltage of about 20 when the engine is throttled down on no-load. The other shunt winding is connected between the outer terminal of the main circuit-breaker and the opposite generator brush, so that it is cut out when the main circuit is broken, a small inductive resistance being permanently connected across the circuit-breaker terminals to prevent an injurious rise of voltage in the shunt winding at the moment of break. The result of this arrangement is that the circuit cannot be re-established at a high voltage, and is accomplished without any additional contacts.

The two shunt windings together give a no-load voltage of 150 at 800 revs. The series winding is sufficient to build up the field on closed circuit without a separate exciter and maintains the voltage for a given number of revolutions nearly constant (but slightly on the low side) with increase of load.

The motors are electrically independent, though they have one yoke in common, and are series wound. The characteristic torque-speed curve of the series wound motor has been utilised to give what amounts to an automatically variable gear within wide limits, so that on average gradients all the necessary relations of speed and torque are obtained by the driver varying the gas supply to the engine.

With a constant engine speed, the car gradually slows down as the gradient stiffens, though not nearly so rapidly as with a generator designed to deliver a constant output, the impression on a hill being one of sustained speed without the necessity of rushing it.

All ordinary running is done on the "parallel" position, but to provide for gradients steep enough to slow the engine down on the "top" speed, the motor armatures can be placed in series by the controller. The two other intermediate speeds, obtained by placing the motor fields in series instead of parallel, are intended more as transition than running speeds. No resistance is used.

The controller reverse speed can be used as an emergency brake, but a stop is conveniently placed to prevent its unintentional use.

The circuit-breaker is connected to the single pedal by a quick-break motion, so that the engine is immediately throttled down and the circuit subsequently broken before the brakes on the propeller shafts come into operation. All

arcing occurs at auxiliary carbon blocks, the main contacts being unaffected; but since a driver naturally throttles down the engine as soon as he sees the road is no longer clear, he does not break the circuit until he actually has to put the brake on, by which time scarcely any current is passing. Consequently, the only occasion on which the full current is broken is an emergency stop, when the ability to stop by simply depressing a pedal and to re-start smoothly by releasing it, may avoid an accident. When the pedal is released, the throttle returns to the position it is set to by the handle, and the actual acceleration of the engine produces its own load by raising the voltage of the generator.

It is found that the rated output of the machine is not even reached until the fully-loaded car is ascending a typical London rise at about 12 M.P.H.; this output has been maintained for six hours with a temperature rise not exceeding 100° F. above the surrounding atmosphere. The efficiency obtained from the generator on full load is 90 per cent., and that of the motor 88 per cent.

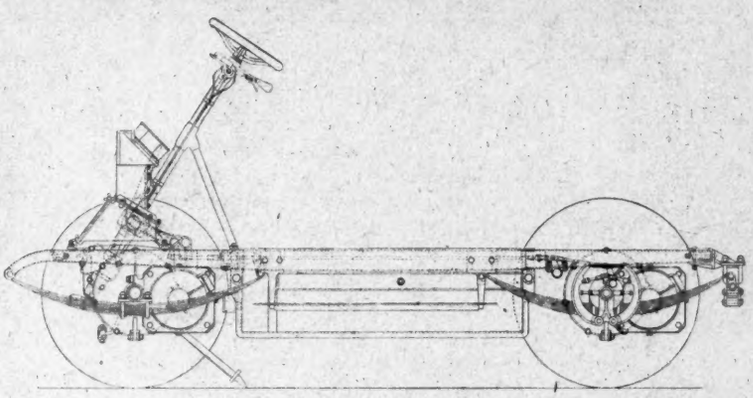


Fig. 2.—Chassis of Silvertown Vehicle.

THE SILVERTOWN ELECTRIC CARS.

The Silvertown electric cars were first brought under public notice at the Olympia Exhibition, held at the beginning of 1905 (see Electrical Review, February 17th, 1905), since which time the manufacturers, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, have been carrying on a series of experiments, including exhaustive road and laboratory tests, in order to produce a standard type of car specially suitable for town work.

The two most noticeable features of the Silvertown chassis are the four-wheel drive and the "fool-proof" control.

The four-wheel drive gives a much more even tractive effort on the road than is obtained with the usual type of drive, and at the same time overcomes the serious side-slip trouble and prevents skidding on steep hills, even in cases where the surface of the road is in a very greasy condition.

By adopting a system of control on their chassis which is practically "fool-proof," the Silvertown Co. have produced a car which anyone can learn to drive and manage after a very short period of instruction, and which is not likely to suffer injury or cause accidents by the carelessness or forgetfulness of its driver. For instance, the mechanical brake acting on the rear road wheels can be applied at any time, no matter in what position the controller handle may be, as, before any braking effect can take place, the electric circuit is automatically broken by means of a quick-break switch, which once having been opened in this manner, cannot be closed again until the controller handle is brought back to the neutral or off position.

Fig. 1.—Silvertown Electric Automobile.

The safety plug, which the driver should always take with him if he gets off the car, as its removal prevents anyone from tampering with the latter, cannot be placed in position or removed unless the switch is open. The same plug has to be used, in another position, if the battery is being charged whilst on the car. The wiring is so arranged that the controller circuit is entirely cut out, so that any accidental moving of the controller handle when the charging is in progress does not do any damage.

The following is a general description of the car, of which a view is given in fig. 1:—

The frame (fig. 2) is of pressed steel, of ample depth and thickness, narrowed in the front, so as to allow a good steering lock, and specially stiffened at the back cross member to support the transverse spring without twisting. The front dumb irons are specially worthy of note, as they are made in one piece with the side of the frame and electrically welded.

The springs are long, and have large eyes, in which are fitted renewable grease-retaining bushes, and they are designed so as to give comfort in travelling over rough roads; they are at the same time stiff enough to prevent undue movement of the carriage.

The two motors are mounted one on each axle casing, thus giving the four-wheel drive. They are totally enclosed, and are fitted with quickly removable covers over the commutators. The motors are capable of working at 50 per cent. overload for a considerable time and at double their ordinary load for a short time without any injury, and are so arranged that should either motor be damaged, the carriage can be run on the other alone. The armatures are mounted on ball bearings, as shown in fig. 3, p. 730, and can be easily removed from the motors. The drive is transmitted from the armature by means of spur gearing, and both the pinion and gear wheel are case-hardened, the latter being mounted on the outside of the balance gear box.

The balance gear box also runs on ball bearings, and the driving shafts, which are of nickel steel turned all over, transmit the drive to the hubs of the road wheels through sliding clutches. The road wheels are fitted with a compound ball bearing containing two journal bearings and one double thrust bearing. The whole of the running gear is completely enclosed by the axle casings.

The driving of the front wheels is obtained by fixing a special form of universal joint on the driving shaft at the same centre as the steering pivot, thus allowing free steering, whilst at the same time transmitting the drive. This universal joint is carefully protected by dust and damp-proof casings.

A prominent feature of the "Silvertown" controller which is not found in most other types is that the current is not broken on the drum, but automatically by a quick-break switch, thus preventing burning of the segments. The same switch, which is fitted with a carbon break, is also independently operated by the brake pedal before any braking can take place, and is held open by a cam when the brake pedal is released, until the controller handle is brought back to the neutral position. The cam is then released, and the switch closed again as the controller handle is moved to the notch required. The controller provides thirteen positions: six forward, three brake and four reverse, all of which are controlled by one handle, which is placed under the steering wheel. The first three steps of the six forward positions are intended primarily as starting positions, but can also be used for slow-speed traffic work.

The whole of the electric controlling gear, that is, the controller,

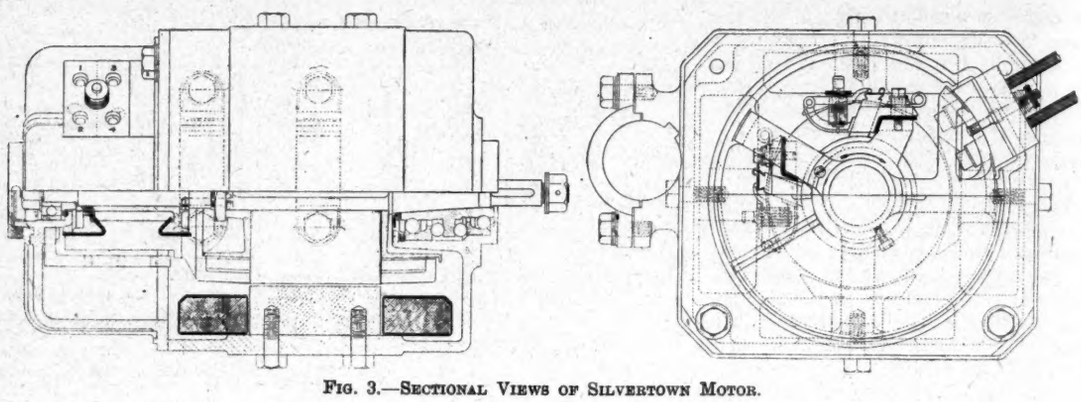


Fig. 3.—Sectional Views of Silvertown Motor.

brushes, resistance and instruments, are contained in one strong aluminium case, which can be easily removed if necessary from the chassis. This is illustrated in fig. 4.

The mechanical brakes are sufficiently powerful to hold the car on the steepest gradient. A strong sprag is fitted, and is worked from the driver's seat.

The steering gear, combined with the bevel wheels for actuating the controller drum, is contained in a steel case, which is made dirt proof, and is securely fixed to the frame of the car. The steering is of the irreversible type, and the connecting rod is provided with cushion springs and adjustable ball joints to take up any shock from the road. All parts are made adjustable.

The battery, which is contained in one crate, is slung underneath the frame; it can be easily detached and replaced by a new one if necessary.

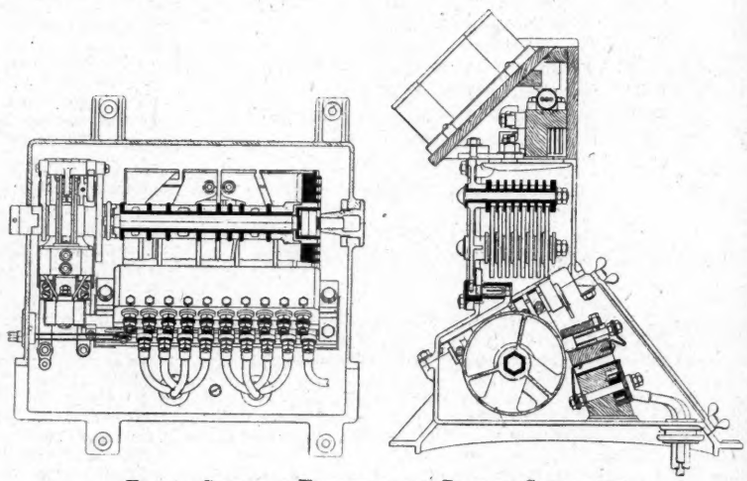


Fig. 4.—Sectional Elevation and Plan of Controller.

PROCEEDINGS OF INSTITUTIONS.

Electric Supply Prospects and Charges as affected by Metallic Filament Lamps and Electric Heating.

By H. W. Handcock and A. H. Dykes, Members.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London and Dublin, April 9th*, 1908.)

With the new metallic filament lamps, two to three times the light can be obtained for the same current as compared with the ordinary carbon lamps used hitherto. But what will happen when every consumer uses high efficiency lamps throughout? Can we feel sure that the only effect will be that the consumer will get more light, and will use as much as or more current than before?

The cost of the lamps—4s. for osrams and 2s. 9d. for tantalums—is a very considerable item, and consumers therefore will not adopt them to any great extent unless they can feel assured that their *total* lighting bill will be reduced, or at any rate not increased.

Table I gives the total cost of lighting at varying lengths of life of the lamps, and at various prices for the lamps.

When lamps are run in series their life depends very much on the fluctuation in voltage on the circuit, and under ordinary conditions it is considerably less than when they are run in parallel. At present breakages in transit are a serious item to be borne in mind when calculating the cost of renewals.

It is common knowledge that, even with the drawbacks above referred to, many large business consumers are putting in metallic filament lamps, two in series, and many stations can testify to great reductions occasioned thereby in consumers' accounts.

In our own private houses we last year tested a plan which appears likely to become very general where alternating supply is available. This consists in putting down an auto-transformer, or "distributor," by which the 200-volt supply is broken up into eight circuits of 25 volts each, thus permitting the use of 25-volt metallic filament lamps of 8 and 14 British candle-power, which are both cheaper in first cost and more efficient and stronger than the 100-volt lamps. The 8-c.p. 25-volt osram lamp is rated at 10 watts, and the 14-c.p. at 16 watts.

We have carefully studied the behaviour of both lamps and transformers, and find them in every way satisfactory.

It may be objected that the transformer losses during the daytime would go far towards neutralising the saving in current during the lighting hours. There is now, however, on the market more than one switch which automatically switches the transformer off when the last lamp is turned off and switches it on again when a lamp is turned on. Under these circumstances we find that the consumption of current for the same illumination is only from one-third to one-half of what it was formerly.

We have taken tests of transformers made by different makers, each wound for eight circuits of 25 volts, 200 volts across outers, for 4 to 5 amperes per circuit at 50 cycles per second. The no-load consumption, all lamps turned off, varies from 15 to 20 watts.

The lamp, unlike the 110-volt one, can be used in any position and fits any ordinary shade, and is listed at 3s.; as an electrolier with six 8-c.p. lamps only consumes the same amount of energy as an ordinary carbon filament 16-c.p. lamp, it is evident that the system presents many advantages.

Continuous-current stations are not affected in the same way, but who can doubt that before long the price of metallic filament lamps will be largely reduced, and a satisfactory 200-volt lamp put on the market?

Whilst to obtain a gross revenue of £1 per annum a gas works has to lay out £4 10s., an electrical undertaking must spend £7 10s.; and whilst the ratio of working expenses to receipts is 75 per cent. in the one case, in the other it is 46·3 per cent. An electrical undertaking requires a much greater margin between gross receipts and working expenses than a gas undertaking, because it has to pay interest on a much greater capital outlay per £1 of gross earnings, and it is generally liable to be bought out for a nominal sum at the end of forty-two years, and has therefore also to provide out of the margin for a substantial sinking fund: a contingency that gas companies have not to meet.

Again, the average cost of a gas service is £1 to £1 10s., but an electric service, exclusive of meter, will not in most cases cost less than £5 to £6; whilst, if a supply be required for heating, it does not, as with gas, simply pass through the same meter, but additional expense has to be incurred for separate meters and wiring, with all its incidental complications both to the supply station and to the consumer. In fact, in the case of electrical energy, by far the greater part of the charge is due to standing charges, interest and sinking fund, which are independent of the amount used by the consumer, the actual cost of production of the current being relatively small.

If any individual consumer reduces his consumption by one-half, the reduction in the amount of profit to the supply company is much greater in the case of electricity than it is with gas.

In the matter of small consumers, when we come to reckon up the cost of "free wiring," repairs, renewals, cost of slot meters, services, &c., we are forced to the conclusion that under ordinary circumstances such consumers do not pay.

The time is opportune to consider whether by any rearrangement it is possible, without raising the price to the average profitable consumer, to make those contribute their fair proportion who at

TABLE I.—Cost per c.p.-hour and Percentage Saving with Different Types of Lamps.

As Compared with 8-c.p. Carbon Filament Lamps, Costing 1/- each, life 750 hours.

Type.	Candle-power.	Price of lamp.	Watt consumption per lamp.	Assumed life of lamp in hours.	Total units used during life.	Price of energy per unit.	Total paid by consumer (including lamp cost) during life of lamp.	Total received by supply company during life of lamp.	Total paid by consumer per c.p.-hour.	Total received by supply company per c.p.-hour.	Amount received by lamp maker per c.p.-hour.	Percentage saving to consumer per c.p.-hour.	Percentage reduction in current sold by Supply Co. per c.p.-hour.	Percentage increased or decreased yield to lamp maker per c.p.-hour.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
						d.	d.	d.	d.	d.	d.	Per cent.	Per cent.	
Carbon	8	1/-	30	750	22·5	4	102·0	90·0	0·01700	0·01500	0·00200	—	—	—
Carbon	16	1/-	60	750	45·0	4	192·0	180·0	0·01600	0·01500	0·00100	5·90	—	50 % decrease.
Tantalum	16	2/9	24	750	18·0	4	105·0	72·0	0·00875	0·00600	0·00275	48·53	60·0	37·5 % increase.
Tantalum	23	2/9	40	750	30·0	4	155·0	120·0	0·00900	0·00690	0·00191	47·06	54·0	4·5 % decrease.
Stearn series lamp* ...	10	1/-	14	750	10·5	4	54·0	42·0	0·00720	0·00560	0·00160	57·65	62·5	20 % decrease.
Osram...	8	3/-	10	750	7·5	4	66·0	30·0	0·01100	0·00500	0·00600	35·30	66·5	200 % increase.
Osram...	14	3/-	16	750	12·0	4	84·0	48·0	0·00800	0·00457	0·00348	52·94	69·4	74 % increase.
Osram...	30	4/-	40	750	30·0	4	168·0	120·0	0·00750	0·00533	0·00213	55·88	64·5	6 % increase.
Carbon	8	1/-	30	1,000	30·0	4	132·0	120·0	0·01650	0·01500	0·00150	2·90	Nil	25 % decrease.
Carbon	16	1/-	60	1,000	60·0	4	252·0	240·0	0·01640	0·01500	0·00075	3·50	Nil	62·5 % decrease.
Tantalum	16	2/9	24	1,000	24·0	4	129·0	96·0	0·00806	0·00600	0·00200	53·00	60·0	Nil
Tantalum	23	2/9	40	1,000	40·0	4	193·0	160·0	0·00839	0·00690	0·00140	51·00	54·6	30 % decrease.
Stearn series lamp* ...	10	1/-	14	1,000	14·0	4	68·0	56·0	0·00680	0·00560	0·00120	60·00	60·2	40 % decrease.
Osram...	8	3/-	10	1,000	10·0	4	76·0	40·0	0·00950	0·00500	0·00450	44·12	66·5	125 % increase.
Osram...	14	3/-	16	1,000	16·0	4	100·0	64·0	0·00710	0·00457	0·00257	58·23	69·4	28·5 % increase.
Osram...	30	4/-	40	1,000	40·0	4	208·0	160·0	0·00690	0·00533	0·00160	59·41	64·3	20 % decrease.
The following examples show the effect of a material reduction in the cost of lamps:—														
Carbon	8	-/6	30	750	22·5	4	96·0	90·0	0·01600	0·01500	0·00100	5·90	Nil	50 % reduction.
Osram...	8	1/6	10	750	7·5	4	48·0	30·0	0·00800	0·00500	0·00300	52·94	66·6	50 % increase.

The figures are given for average lives of 750 and 1,000 hours.

Column 13 shows for price of current at 4d. per unit, the total percentage saving to be effected by substituting any of the lamps enumerated, for a carbon filament 30-watt lamp, costing 1s., and having a useful life of 750 hours. [The complete table gives prices from 2d. to 5d.]

Columns 14 and 15 show how supply station and lamp-makers respectively are affected by the same change.

* Stearn compound lamp; price given for single element.

present do not do so, and also to encourage the use of current fog various purposes besides lighting, thereby extending the hours over which the station's large capital expenditure is earninr interest.

The present arrangement of differentiating between the charges for lighting and heating is inherently absurd.

Why should current, consumed during peak times, be charged at low rates simply because it is not used for lighting? Surely all the current used at the same time of the day should be charged at the same price, for whatever purpose it may be used.

Under Sec. 31 of the Electric Lighting Clauses Act, 1899, undertakers may charge for electrical energy by the actual amount of energy supplied, or alternatively by such other method as may for the time being be approved by the Board of Trade, and in most orders the Board have fixed the maximum charge for any amount up to 20 units at 13s. 4d. and for each unit over 20 units 8d. In some cases the rate of 7d. is substituted for 8d.

This entirely fails to meet the case of the very short-hour consumer or the man who wires his house for, say, 1,000 lights, thereby entailing a considerable capital outlay on the part of the supply company, owing to their liability to supply him at any moment, and may tender the company the magnificent sum of 13s. 4d. per quarter. Neither has either of these cases been met in the past by the maximum-demand system, limited as it is by the maximum charge of 8d. per unit and the minimum of 13s. 4d. per quarter.

In our view, the only satisfactory system is a fixed rental in addition to the charge per unit.

If electrical undertakings are to be helped at the present juncture by the extended use of current for power, cooking and similar uses, in the same way that the gas stove and cooker came to the rescue of the gas companies, it is essential that the whole of the business be simplified. It must not be necessary to put in a separate meter, separate wiring, and to render two separate accounts, but, nevertheless, it is equally essential that current for power should not be sold for a low rate simply because it is for power, and the loss made good by lighting consumers.

The great majority of domestic heating appliances take a current of under 5 amperes, and it should be possible to attach any such piece of apparatus to any convenient plug on the general house wiring. Electric heating appliances could be put on the market much more cheaply than at present if the demand were greater, but there is little inducement to the makers to cheapen them under existing conditions.

It appears to us that all the difficulties, practical and theoretical, might be met if the present minimum charge authorised by the Board of Trade were made to depend on the maximum power with which any consumer should be entitled to be supplied.

Sec. 28 of the Clauses Act of 1899 entitles the consumer to a supply up to the maximum that may reasonably be anticipated on his premises, and why his standing charge should not be based on the number of kilowatts corresponding to that maximum instead of on an arbitrary 20 units, it is difficult to see.

If a suitable *maximum* figure per kilowatt were fixed by the Board of Trade for that purpose, the actual figure charged by the station could be made to correspond to the standing charges of that station, when it is clear that the charge per unit would resolve itself into production costs and nothing more.

We venture to make the following suggestions for working out the system in practice:—

A consumer applying for a service states as at present the number and candle-power of lamps he proposes to use, say, for example, 200 8-c.p. lamps. From his knowledge of the district the station manager estimates that the maximum demand he is ever likely to make on the station is, say, 3 kw., which he accordingly enters as his "contract demand."

For the privilege of having the call at any time on power up to 3 kw. the consumer will pay per annum a fixed sum, and in addition a small charge per unit for the actual energy supplied as measured on the ordinary meter. The fixed charge represents the cost the station is put to in placing at his disposal a supply up to 3 kw., and is independent of whether he actually uses a unit or not. It is arrived at by dividing the sum representing the whole of the "preparation costs," that is, all those which are independent of the actual output of the station, including, in the case of companies, a reasonable dividend, by the sum of the consumers' "contract demands." The charge per unit is intended to represent the "production cost" per unit consumed, with a reasonable margin of profit.

A certain alternating-current station, for instance, has a maximum load of 713 kw. on the station feeders, and the sum of the consumers' "contract demands" would probably be found to be about 990 kw., depending on the nature of the load supplied.

The interest and sinking fund charges absorbed £6,203
The rest of the "preparation costs" amounted to 4,449

Giving a total of £10,652

This divided by 990 = £10 15s.* as the standing charges per "contract" kilowatt demanded. The "production costs" per unit were 0·87d., say, 0·95d., allowing a margin for profit.

The charges would therefore be £10 15s. per "contract" kilowatt demanded, and 0·95d. per unit consumed.

It would be desirable to insert in every house a "limit indicator," the function of which is to throw a resistance into the circuit, and thus indicate to the consumer by a reduction in the brilliancy of his lamps when he is exceeding his contract limit.

The point in which this method differs from the Wright system is that the consumer can determine his own maximum, and unless he asks for his limit to be raised, he knows within a little exactly what his bill for current is to be.

On the new plan, if he exceeds his demand he knows it, and has either to reduce it or to apply to the station to have his limit indicator set higher, thereby acknowledging that his requirements are greater and therefore should be paid for accordingly.

It appears to us that the method is one which appeals to all consumers, and its advantages to the stations are obvious. All pay their fair proportion, whether short or long-hour consumers, whether the current be used in the small lamp for lighting or the large lamp for heating, the desirable long-hour consumer is encouraged, and

* By taking 990 kw. instead of 713 kw., the maximum load on the station feeders, the consumer gets due allowance for the diversity factor.

those with a very bad load factor either pay their proportion or go off the main to make room for more profitable consumers.

There is every inducement to use radiators and cooking apparatus. When an electric kettle can be bought as an ordinary article, taken home and plugged into any of the ordinary plug sockets, the demand will be such that the price will quickly come down and their use increase at compound-interest rate, for as long as they are used in such a way as not to increase the load beyond the contract limit, the only charge will be the small one for so much additional current, in the case of the station above referred to, for instance, 0·95d. per unit. The contract rental will, of course, be regulated to suit the prevailing conditions, and will include the ordinary meter rental, which will disappear. Special circuits and meters for heaters and motors will also be no longer necessary.

If still more economical lamps are introduced, thus reducing the aggregate of consumers' contract demands, the contract rental per kilowatt will be raised. If the gradual expansion of the station reduces the cost per kilowatt of contract demand, the rental per kilowatt will be reduced.

If motors have the right to come on the mains at any time, the current consumed by them must be paid for at the same rate as the current for lighting under the same conditions; it is only when the motor current does not increase the peak load that it should be charged at a lower rate. Many stations are now penalising their lighting consumers to supply current for power and heating at low rates, and if the demand for such power increases, the price as compared with the price for lighting current would have to be raised. The two overlap, and it is just as reasonable to let the lighting consumer have current at a low rate because he uses the machinery at night, when it would otherwise be doing nothing, as the day load is shut down, as to let power consumers have power current at a price which only covers the works cost.

If, on the other hand, in a special case a power consumer were to undertake to use his motors only between certain hours, he would thereby enable the station, for the same capital expenditure, to supply a larger aggregate of demand, thus reducing the price per kilowatt of contract demand. He would then be entitled to be charged at a lower contract rental per kilowatt.

The limit indicator can be dispensed with, and the contract rental arbitrarily fixed by the station, as is now being done in the case of varying flat rates, or an ordinary maximum demand indicator can be installed and the consumer informed that the contract rental will be so much, provided that the indicator does not show that the assumed contract demand has been exceeded at any period during the whole year.

Since this paper was written our attention has been called to an interesting system adopted by Mr. F. W. Long, City Electrical Engineer of Norwich.

Private consumers in Norwich have the option of taking a supply either at a flat rate of 4½d. or on an "assessment tariff." This tariff consists of a fixed charge of 12 per cent. upon the net assessment of the house and 1d. per unit for all current used. The system possesses many of the practical advantages of the one suggested in the paper, in that it encourages the long-hour consumer, and also the use of radiators, kettles, &c., without requiring a separate meter. Mr. Long informs us that "the result has been that people have used considerably more current and that radiators are becoming popular." He is quite satisfied with the working.

Discussion.

The London discussion was opened by Mr. Arthur Wright, who committed himself by asserting that if the metallic filament lamp question were left to the wiring contractor, a bad time would result. He suggested that it was a mistake to advertise the possibility of obtaining "the same amount of light at one-third of the cost;" it should rather be three times the light at the same cost. Electrical users were (in contra-distinction to gas users) tramelled by innumerable regulations as to safety; he suggested that the fire insurance regulations were really sufficient for all purposes. There were great possibilities in the new lamps if the matter was properly handled, as the cost of extending the electric lighting business was nothing like the average cost. As an instance, an increase of 8 per cent. in the Marylebone capital would enable the output to be doubled. The diversity of a power load justified lower charges at peak times; the Stepney motor load had a diversity factor of about 4, but for lighting the diversity factor was only 1½. Motors were rarely constantly loaded like lamps, and this effected the standing charges. In concluding, he remarked on the expense of house services, at £9 to £10 per service, a reduction in which would much facilitate business.

Mr. Hugo Hirst criticised the authors' figures as to candle-power and life of the tungsten lamp, which he considered had been unjustly treated. As regards "pairing," these lamps were now so accurately made and ran with such slight alteration, that it was possible to pair new and old lamps quite satisfactorily. The lamp-makers were really great losers on the new lamps; the introduction of the latter seriously depreciated the makers' stocks of carbon lamps and the plant in their works. He thought the station engineers ought to be prepared to share any loss arising at the present time.

Mr. C. B. Smith believed that the contract demand system of the authors would be detrimental from a consumer's point of view—they would hesitate to adopt it. Houses services were an expensive item, but they cost much less than £10 (suggested by Mr. Wright).

Mr. W. R. Rawlings, speaking from a contractor's point of view, commented on the demerits of the Wright indicator, which he had never yet found any consumer able to understand. This and similar systems did not lead to full use of the consumer's installation. Commenting on multiple rates of charging, he said he knew of houses in Kensington where the terminals, meters, &c., were in triplicate, all through the different systems of charging for heating, lighting, &c. He thought this often prevented the adoption of heating apparatus. He had compared the authors' contract demand system with the present rates of charge in certain cases, and taking a boarding house consuming an average of 33 units per lamp on 49 lamps, and assuming the contract to be two-thirds the maximum demand, on the authors' system the charge would be 426s. per annum, as against 630s. at present. In another case of a bad consumer with 176 lamps, who only averaged a consumption of 8 units per lamp, assuming a contract of one-third of his maximum demand, the year's bill would be 715s., as compared with the present charge of 634s. The average consumption of a large number of consumers was 15 units per 8-c.p. lamp, and taking a contract of one-third maximum demand, the average annual cost per consumer would amount to 384s., as compared with 353s. at 5½d. per unit.

Mr. F. M. Long (Norwich), whose "assessment tariff" was referred to by the authors, said he found an average energy consumption of 7 units per £1 assessment, taking both small and large houses in Norwich. He had tried the assessment tariff for 15 months and had now 800 consumers connected on that system. It obviated meter rents, duplicate wiring, &c., and the consumer understood his bill. He found that 250 consumers had increased their consumption some 20 per cent., but the average revenue dropped from 4½d. to 3·1d. per unit. Consumers willingly extended the lighting to all rooms, and some hundred radiators had been supplied to them. The effect of the arrangement on the station load, so far as obtainable, showed a 1½ per cent. increase in maximum demand, with an 8 per cent. increase in consumption on a typical Sunday evening. He did not greatly favour the authors' contract demand system; the limit to lamp use was an objection, and, indeed, he pointed out that an evening party did not necessarily increase the maximum demand on the station, as the guests would be using less energy in their own houses. A better arrangement than the limiting device was to maintain the lamps, when they would be regularly inspected, and could be checked as to number. By his own system different classes of supply were all metered through one instrument, and charged at a standard rate of 1d. per unit, the fixed charge per kw. only being varied.

At the resumed discussion (April 23rd) Mr. C. P. Sparks said he did not take such a pessimistic view of the metallic filament lamp problem as the authors did. He anticipated a gradual change-over, with an extended field of operations and improvements in the lighting standard. The small purely lighting concerns would, of course, suffer, but mixed supply undertakings would not be greatly affected. He voiced a fairly general opinion that simple methods of charging as, for instance, flat rates, greatly facilitated supply work.

Mr. C. H. Stearn commented on the difficulty of making metallic filament lamps for the pressures now in use. The concentration of light was not economical for the user, and the large lamp cost more in replacements. If the lengthy filament of the present type lamp were divided up into several smaller lamps, which could be renewed separately, it would be much cheaper in the long run. Such smaller units (used in series) could be placed where required, and any difficulty in localising a broken unit, when one of the series failed (in the ordinary way extinguishing all the lamps of the series) could be overcome by using a small cut-out attachment actuated by the heat developed by the breaking of the filament. An arrangement of this kind, with a shunt resistance and fuse fitted in the lamp, was shown with a view to demonstrating the advantages of smaller metallic filament lamp units used in series, whereby only the faulty unit failed, the cost of replacement in such a case being, of course, much less than for a whole lamp.

Mr. P. Still said it was impossible to form an idea as to how a consumer would use his installation, and so any arbitrary fixing of the contract demand would certainly lead to trouble. The limit indicator was also a weak point; London householders were especially irregular users. He considered that only the simplest possible system of charging was admissible.

Mr. Leonard Andrews believed there was something in the authors' remarks on falling off in revenue due to the use of the more economical lamps. He knew of cases where they were feeling this effect seriously now. Some reference had been made to the system of charge of 10s. per lamp per annum adopted at Hastings; this arrangement worked remarkably well, was understood, and led to a largely-increased energy consumption and an improved load factor. He could not agree as to the equity of the flat rate in all cases.

Mr. John F. C. Snell took an optimistic view of the future with the new lamp. He further believed that a commercial high-voltage lamp would come and enable all temporary expedients to be done away with. He noted from the authors' comparative financial data of gas and electrical undertakings that the latter were making a better percentage net profit than the former, and that if the gas undertakings had the same scale of financial charges as the electrical concerns, they could not possibly go on working. He believed in the flat rate, although not scientifically correct, and suggested that we should eventually adopt flat rates with discounts.

Mr. Robt. Hammond said the standard of illumination was now too high in some private houses, and it would hardly be raised, but the more economical lamps might lead to extensions of installations. He had compared the London electricity outputs in recent years in view of the introduction of the new lamps and found annual increases of 34, 23, 27, 17, 19, 13 and 12 per cent., in each case over the previous year, the last figure being for 1907. Speaking as regards Hackney, there was no doubt of the falling

rate of increase of consumption due to the use of the new lamps. As regards a system of charging, a flat rate had objections in the case of unprofitable short-hour consumers; he thought the contract demand system was on the right lines, and hoped that some such system might be made generally applicable to supply undertakings.

Mr. Leon Gaster suggested that a consumer should only be charged on his maximum demand when the charge was less than by a flat rate, if both systems of charge were in vogue. The consumer should not have to calculate anything as that was a matter for the engineer. He believed the metal filament lamp would prove a boon to the industry, but it must be pushed by suitable canvassers who knew their business. It might be possible to stop cut-throat competition between gas and electricity, if some mutual limitation of their spheres of work were decided on.

Mr. K. A. Scott-Moncrieff remarked that the metal filament lamp, if largely adopted, would cut off the peak load—unfortunately it would also cut off the profits. He thought it would take some five years for matters to settle down, and by that time other classes of supply would have undergone considerable development. Possibly the lighting rates would then be so low as to enable domestic electrical heating to become general.

Mr. Ruthven Murray, referring to the extensive use of the new lamps in certain districts, said that the fears as to the effect of the low power-factor of numerous small transformers on lighting installations had not been justified. His experience was that the six-light free-wired installation in small towns was an excellent thing, the energy consumption averaging 20 units per lamp. He suggested, as one reason, why the maximum demand system had given trouble, that the wiring contractor himself did not understand it. He considered that there was great advertising power in a system having a high fixed charge and a low charge per unit.

Mr. Frank Gill commented on the maximum demand system, which appeared to him to act as a deterrent to consumers. The sliding scale adopted for telephone charges was a very wide one, and was equivalent to the maximum demand rate, but a decreased consumption did not lead to a loss.

Mr. R. B. Matthews considered that the ill-effect of the metallic filament lamp on revenue would only be temporary, and that there was much chance for further development with it, especially if backed by a suitable publicity campaign. The cost of house services was gradually decreasing, one London district having averaged £4 per service; meters could also be obtained for 30s. to 40s. each. He considered that any system of charging should allow of wasting rather than encourage economy in the use of energy.

Mr. W. M. Mordey suggested that "wire lamp" was a more appropriate and convenient name for the so-called metallic filament lamp. As regarded the maximum demand system, taking the average of all the stations using it and comparing with those which did not use it, he found that it did not do anything which it was supposed to do as regard price of supply, load factor, energy consumption, &c., but it did add enormously to the expense of apparatus in the opening years of an undertaking. He believed in simplifying charges and supply arrangements to the utmost.

The President (Col. Crompton) remarked that most of the speakers emphasised their own point of view; some undertakings would undoubtedly show an adverse effect from the new lamps. He thought we were nearly at the bottom as regards supply costs, and improvement would only come from a better load factor and increased output. Great efforts had been made in this direction, but the result was disappointing. He agreed as to the utility of the Norwich assessment system; it was equitable and easily understood, and it touched a serious problem; for there was no doubt but that the smaller consumers really made up for the deficiencies of large lighting installations, such as, for instance, the large Government buildings in Westminster with their short lighting hours.

Mr. J. E. Tapper (Beckenham), in a communication, said that in the district supplied by his station, one house in six was already supplied, against an average all over the country of only 1 in 10, and the prospect of picking up a sufficient number of new consumers to cover the immediate loss, through reduced output, was very remote. It was quite possible for the 1,200 consumers at the station referred to, to effect a reduction in their total consumption of 25 per cent. To give the same revenue, therefore, as at present, 33⅓ per cent. in consumers must be added to the mains at a capital cost of £3,500 for services only, or an additional annual charge of £200 plus extra cost of maintenance of services and collection. During the years occupied in securing the additional consumers, it was possible that the undertaking would have to run at a loss unless either meter rents or the prices charged per unit were raised. The whole thing amounted to this:—If the finances of the station would not allow of such a reduction in the charge for current supplying ordinary carbon lamps, then they could not stand the reduction in consumption due to the metallic lamps and either meter rents or current charges must inevitably be raised. A serious feature was the introduction of small transformers; these, being cheaply designed on the economy coil principle, give a very low power factor unless worked at full load, and might seriously affect the capacity of the plant and mains.

Mr. W. R. Cooper (communicated) said, with reference to the various opinions as to the effect of the new lamps, it was worth while to remember that a great deal had been done in recent years for the station engineer, and it was only fair that the consumer should now begin to benefit. The consumer had suffered by having to use comparatively inefficient lamps to enable the station engineers to use higher pressures. Doubtless the consumer had benefited in a way; he got his energy at 4d., instead of 6d., but he had to use 6 units where 4 units ought to be enough. He (Mr. Cooper) thought there would not be any great falling off in revenue except on alternating-current networks, and this would be more than counterbalanced in many cases, after a time, by the new fields rendered available by metallic filament lamps. Any restrictions on consumers would be most unwise, and the raising of prices as a solution to the difficulty should be adopted only as a last resource, as it might interfere seriously with the use of electricity for purposes other than lighting. Probably the most important point raised by the authors was the question of the small consumer. Cheap light was essential to him, but if he became unremunerative owing to the cost of the service, it would be a serious matter. It would be necessary to modify our methods, and to imitate those in use on the Continent; but this would not come about without some combination between contractors and station engineers. There was much to be said in favour of the tariff suggested by the authors; and it was often absurd, as had been pointed out, to distinguish between different uses to which the energy was put. The great defect, however, of all systems depending on a maximum demand was that no distinction was drawn between different times of day. If a heavy load consumer did not come at the time of peak load at the station he would be welcomed; but any maximum demand tariff discouraged it, and thus the use of energy for heating was penalised.

Mr. A. H. Dykes, replying, said that there was undoubtedly room to raise the price of supply to metallic filament lamps, and still leave a saving to the consumer, and this would nullify the adverse effects on those stations supplying lighting only. He thought it all very well to talk about increasing the output by using more efficient apparatus, but why not reduce the prices to, say, one-half, in the hope of doing the same thing? Some speakers, while advocating a flat rate, actually used a system of fixed charge with an additional charge per unit, which was almost identical with that suggested in the paper. As regards the authors' proposed system, it was necessary to remember that it was on the contract, not on the maximum demand, that the charge was based. The contract demand would enable power consumers, with a diversity factor, to obtain lower rates, depending on what demand they fixed on. In actual practice, small stations found that one or two entertainments held simultaneously, did increase the load, and he considered that this applied in the case of private parties. There was no suggestion of arbitrarily fixing a consumer's contract demand; if necessary it could be adjusted after a few days or weeks, according to circumstances. The flat rate did not give the consumer any idea as to the probable amount of his bill, while with the contract demand system it was not a difficult matter to estimate it; further, the system would tend to equalise the quarterly bills, and so avoid much complaint.

(*Owing* to pressure on our space, the Dublin discussion is held over to next week.)

CORRESPONDENCE.

***Letters received by us after 5 p.m. on Tuesday** cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Placing Orders Abroad.

I have observed several letters in your paper recently on this subject, and as I am somewhat interested in it perhaps you will allow me to express an opinion thereon.

And my opinion is very briefly as follows:—The Britisher cannot help himself, and he must place orders abroad.

The Britisher is an enterprising soul, free as the mountain air, and he sends his commercial representatives out to swelter under tropical suns and regions of icy cold, with what object? To sell his manufactures, which consist of battleships, torpedo craft, merchantmen—steam and sailing vessels, locomotives, boilers, engines, electric machinery, tramway systems, submarine cables, textile machinery, cotton goods, pottery, Birmingham ware, &c.; in fact, every blessed thing that John Bull can turn an honest penny by, he has it for export. In addition to this, there are the services of consulting engineers, draughtsmen, experts in one and another branch of business, shippers, export merchants, bankers, financiers, legal luminaries, &c., all engaged in foreign business.

Who pays for all this advice, experience in engineering in all its branches, and for all the hundred and one things, large and small, indicated in the above short summary, from the getting of the raw materials from the mine, to the shipment and the shipping charges?

Why, the foreigner. And what has he got to pay with? Gold? No. But instead of gold he has goods, consisting of the fruits of the earth, raw materials, and manufactured articles.

So the Britisher first of all barters for food and raw materials. When he has got what he can utilise of these,

there is a big balance left over, and the foreigner, to pay his debts, cannot send anything else in these commodities, as we don't want them. So John Bull says, "Oh, why, I want an electric generator for Hull; send it along," and the foreigner does so, in part payment for goods or services received.

In your current issue I observe that John Bull sold during 1906-7 to *India alone* :—

Electrical machinery to the value of	£154,265
„ instruments, &c., to the value of ...	296,612
Scientific „ „ „ ...	85,083
Steam engines, excluding locomotives... ...	805,136
Rolling stock, &c....	965,702
Total	£2,306,798

Here 2·3 millions worth of goods have been sold, and because Hull proposes to purchase a generator from abroad, worth a few hundred pounds, a few silly people tumble over one another, shout themselves hoarse in feverish excitement, and expose their crude and funny ideas on foreign trade.

It does not matter whether goods are sold to India or any other nation, or all the nations of the earth, *if we cannot take in full payment food or raw materials*, we must take from the foreign nations with whom we deal, manufactured articles to make up the balance. And if those who are opposed to this procedure will indicate the course, legitimate and sensible course, as to how payment shall, or can be otherwise made, I, for one, shall be obliged.

I want a sensible answer, not any of the balderdash of Tariff Reform, or stock tomfoolery of making the foreigner pay impossibilities, nor any reference to British workmen being in or out of employment.

As we cannot possibly take in exchange food and raw materials for all our own manufactured exports, what procedure do those gentlemen propose, who object to the foreigner sending machinery to Hull to discharge part of the balance of his indebtedness?

John I. Hall.

London, W.C., *April 25th*, 1908.

Regulations of Supply Authorities.

Can an electric company who supply current under a provisional order demand any degree of insulation test they may wish to specify in their rules and regulations?

In certain damp situations it is at times difficult, with the best of work, to obtain the insulation resistance specified by the Institution of Electrical Engineers. Can a company, as referred to above, demand anything they wish to in excess of this?

Fair Play.

[Some authorities have secured clauses in their provisional orders which empower them to make their own regulations. But even those which have not this clause have still the power inherent to their ability to withhold connection to the mains, and are thus able to enforce their regulations, whether legally valid or not.—Eds. E.R.]

Bulk Supply.

Messrs. Bowden and Tait wish to revise my calculations in three particulars, viz. :—

1. Capacity of existing stations.

It is quite correct that this is about 200,000 KW., and I much regret my error in taking a higher figure. It may be noted, however, that this refers only to the County of London, whereas their scheme would cover a much larger (and very fat) area. Further, the load would have increased quite 20 per cent. before any such scheme could take definite shape.

2. Percentage of reserve plant.

Fifty-three per cent. is, in my opinion, excessive, but as it represents the proportion at present installed, let us assume that it would still be maintained.

3. Diversity factor.

The suggested figure of 20 can hardly be taken seriously; and Messrs. Bowden and Tait ought to know that to take a diversity factor of two does not involve the assumption that half the plant in the local stations would be disabled at once. They must admit that the diversity factor should be less than the value

$$\frac{\text{max. plant capacity out of commission in any one station}}{\text{average ditto.}}$$

It is necessarily a matter of opinion what that value would be, and what lower value for diversity factor would be safe. I leave it to your readers to judge for themselves whether they would care to be responsible for a factor of 20, and whether 3·0 would not be much nearer the mark.

The revised calculation for capacity then takes the following form :—

Assuming that the load continues to increase 10-13 per cent. per annum, at the end of about four years all stand-by supply will be obtained from the central undertaking; the latter will then have a capacity equal to—

$$\frac{\text{present gross capacity} \times \text{percentage of reserve plant}}{\text{diversity factor}} = \frac{200{,}000 \text{ (at least)} \times \cdot 53}{\text{diversity factor}}.$$

So that, unless the diversity factor could be increased, the plant would still have a capacity of 30,000 to 40,000 KW., for which it would be good practice to put in 6,000-KW. units.

The diversity factor is the point at issue, and that must remain a matter of opinion.

As regards the last paragraph of your contributors' letter, experience has shown that the difference between the efficiencies of a large modern station, with 5,000-KW. units, and the existing stations, is large enough to cover transmission losses. One might reasonably expect that this fact would be known to them. So much for bulk supply.

For the rest, let me conclude with the assurance that I have no grievance whatever against Messrs. Bowden and Tait, nor against the St. James' and Pall Mall Supply Co.

I did not say that they were attempting to boom the Poplar undertaking.

Six-Phase.

Cheap Light.

A circular has just come into my hands, and candidly, it is somewhat of a puzzle to me. I would, therefore, ask you if you could enlighten me as to what it means? Surely in these days of advancement we are not going to adopt the policy of sitting on the sea shore, threatening the waves with a broom?

Ajax.

April 24th, 1908.

[We refer to this matter in a leaderette in this issue, where a part of the circular also appears.—Eds. E.R.]

Measurement of Illumination.

Mr. Edgcumbe's letter in your last issue still labours the point as to whether it is possible to measure horizontal illumination in the street with any degree of accuracy; and I think it will be generally agreed that the curves and figures he gives prove that it is not.

For instance, in the curve plotted from figures taken by Mr. Ellis at an angle of incidence of 80°, as far as can be seen from the curve, the measured illumination was ·163 and the correct illumination ·174—an error of over 6 per cent.

The tests in St. James's Park and Oxford Street can hardly be taken as being of much value, as the candle-power of arc lamps varies so rapidly that if the readings were taken consecutively they would have little relative value; but supposing they are correct, an error of 10 per cent., where it cannot be accounted for by reflection, is a serious matter.

The fact, therefore, remains that if it is desired to make measurements with the screen at a large angle of incidence—such as is necessary when measuring horizontal illumination in the street—the screen must be a perfectly plain surface, free from any irregularities. This postulate is very difficult to fulfil, as the investigations of Mr. Wild, Mr. Trotter and

others have fully proved; and it is certain that any surface such as that of cardboard or paper is not good enough. Therefore, until a screen having the right surface is forthcoming, it would be wiser to take measurements at the angles where this source of error does not occur, as pointed out by Mr. Lancelot Wild in your "Correspondence" columns.

Haydn Harrison.

London, S.W., *April 27th*, 1908.

Central Station Information Bureau.

I read with interest Mr. Matthews's article on the above in your issue of April 17th, as it is a matter which I have often endeavoured to get taken up generally.

We all want information at times, and are pleased to reciprocate by supplying same when asked for, within reasonable limits, but to enable all such information obtained to be available for everyone seems to be a somewhat difficult problem.

To publish all the questions and tabulated replies on various matters would require a journal to itself.

For every engineer to distribute broad-cast the tabulated replies that he has received (although this is very often done) entails a large amount of time and expense.

The plan that I have adopted and found very useful is to tabulate and file all the sheets of queries that I receive (between 200 and 300 to date), and when requiring information on any special point I refer to this file, from which can be found who has previously obtained information on this subject or something akin to it, and communicate direct with that engineer, asking him to let me have on loan the replies which he has already received, and which will generally be found to supply the information required, unless, of course, they are dated too far back.

I think if this plan was more generally followed, much of the present overlapping of questions would be stopped, and each engineer would feel that when sending in his replies, he was contributing to valuable statistics, available for himself and others when required.

Let each engineer keep and file all query sheets, also put together the replies he receives in such a form as they can be easily sent by post, and a great deal will be done to meet the present deficiency so ably pointed out by Mr. Matthews.

R. L. Acland.

Chesterfield, *April 21st*, 1908.

Metallic Filament Lamps.

At the discussion on Messrs. Handcock and Dykes's paper on Thursday evening last week, Mr. Mordey very correctly objected to the term "metallic filament lamps," and suggested, as an alternative, "wire lamps." This name would quite meet the case were it not for the fact that it conveys an impression which, as regards most of the new lamps, is altogether wrong. The only lamp which may properly be called a "wire lamp" is the tantalum, as the filament is actually formed of drawn wire. All the other new lamps have squirted filaments which under no stretch of the imagination could be termed "wire." If the tungsten lamps really had wire filaments there would not be so many breakages.

B.

The Effect of Radium upon Gems.

For a considerable time I have been experimenting with various gems exposed to the action of radium. It is generally supposed that all kinds of coloured stones can be produced from suitable colourless specimens. This, however, is not the case, or at any rate, the time to produce a change in colour is exceedingly prolonged. Some specimens coloured in a few days, others after many months underwent no change, as if in these "creation" had been completed. But the most remarkable fact I have elicited, and I believe unobserved or unpublished till now, is that diamonds become fluorescent under the radium emanations, and remain so for a long period. When the stones are upon the radium, the appearance is very beautiful. The result is only brought about after a very long exposure to radium. In a Crookes tube the effect is known, and the fluorescence is green, but with radium it is an ethereal blue with sparkle. The result may interest some of your readers.

David Salomons.

London, W., *April 24th*, 1908.

Wiring Systems.

For an all-round job, I consider wood-casing for small houses the ideal one, as there is no fear, when once put in, of an unsound job, unless very poor rubber is used in cables and joints; no chance of fires by coming into contact with water or gas pipes, as with iron pipes, especially when corrosion of earth wire on pipes takes place, or bad connection to earth; no internal condensation; no straining of insulation and mechanical protection of cables in drawing in. Some wiring done by the writer on a large system, 16 or 17 years ago, is as good as when first put up. The weak places in wiring of all descriptions are the points where cables leave casing or pipes and enter switches, fuses, &c., especially in a continuous supply where the neutral is earthed, and electrolysis gives trouble.

H. E. Holmes.

Edinburgh, *April 25th*, 1908.

Alignment of Steam Generator Shafts.

In answer to the letter of "Engine Practice," appearing in your issue of the 24th ult., I should suggest, as a possible method of overcoming the difficulty, the use of a flexible coupling, when so long as the shafts of the engine and dynamo were running truly in their respective bearings, any slight non-alignment would not be noticeable, and the trouble of hot bearings would be avoided.

I believe that the Union Electric Co., Ltd., of Park Street, Southwark, provide a flexible coupling called the "Southwark," and no doubt they would be only too glad to give full information.

H. W. C.

Looping-in versus Jointing.

In my article on "Looping" in issue of April 17th, the paragraph at foot of left-hand column on page 677, speaks of electrolysis in damp places, and of dust troubles in positions decorated in light colours.

Through a copying error of omission it is not very clear, and suggests that such troubles occur only when current is "flowing." It was intended to refer to the use of single or D.P. switches for entirely disconnecting such places when light was not required, and to point out that often this was less easily done with looped circuits. But its main purpose was merely to accentuate further the fact that all dangers, defects and complications are increased when the length of conducting wires is added to in "looping" for "looping's" sake.

The diagram on fig. 2 has been reduced considerably, and, perhaps, does not show very clearly the gaps in the negative wire which were intended to indicate the positions where the negative ends were "looped" into lamp-holders.

In the final paragraph "supplies" ought to read "suppliers."

Donald S. Munro.

Edinburgh, *April 25th*, 1908.

In reference to the above article by Mr. D. S. Munro, A.M.I.E.E., in your last issue, if the way of carrying out the system is in accordance with his diagrams, which he says is common, the average condition, and not specially selected, I think it would have been more profitable had he given a few hints on a more convenient and economical way of carrying out the system. For he does not condemn the system on the whole, and I take it that he is only against it as far as this or similar (fig. 1-2, p. 676) circuits are concerned. The disadvantages are: waste of wire, the tubes are tightly

packed, no ventilation, and inconvenient; but for these disadvantages, I take it that he would prefer the looping-in system. Looking at his diagrams and taking his own calculations for 70 yards, we find that this circuit requires 94 yards of tube and 243 yards of cable; and there are four wires in one tube. The disadvantages are got over by fig. 1*a* and 2*a* (not novel), the same circuit taking 70 yards of tube

Fig. 1*a*.

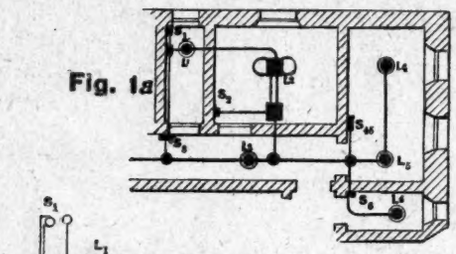


Fig. 2*a*.

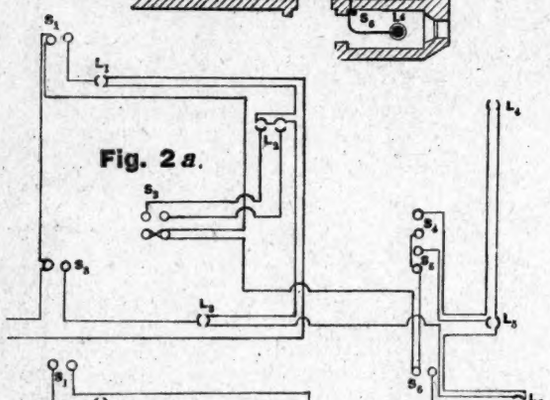
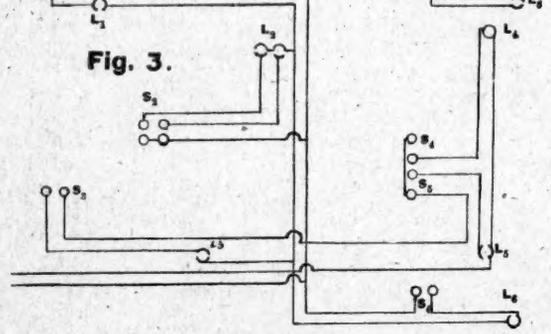


Fig. 3.



and 186 yards of cable, and there are only three wires in one tube, with the exception of S5 to S6, so we gain 24 yards of tube and 57 yards of cable, with ample room in tube. Now, could the same circuit be wired out on the jointing system, and save 40 per cent., as he says? Fig. 3 is a diagram of the joint system, and the gain is about $1\frac{3}{4}$ yards per joint.

O. R.

PARLIAMENTARY.

Blackburn Corporation Bill.—Mr. Corrie Grant's Select Committee of the House of Commons on Tuesday concluded the consideration of the Bill promoted by the Blackburn Corporation, and found the preamble proved. Part 3 of the Bill, which deals with tramways, provides for the construction of 10 small sections to link up various portions of the existing system. Borrowing powers to the extent of £9,200 were authorised for this, to be repayable in 20 years. Clause 39 gives the Corporation power to run omnibuses as part of the tramway undertaking, and Clause 40 enables the Corporation and the Blackburn, Whalley and Padiham Light Railway Co. to enter into agreement with regard to the construction of so much of the light railway as is intended to be situate within the borough. Under Part 7 of the Bill, the Corporation is given power to lay mains for electricity in streets or roads not dedicated to the public use, and to construct electrical sub-stations under streets. A statement was submitted to the Committee showing that the total borrowing power, so far sanctioned for electricity purposes, was £257,699, of which £141,000 had been exercised. The amount of the mortgage debt outstanding on March 25th, 1908, was £121,550. For tramways the amount of loan authorised was £290,000, and the borrowing power exercised £169,867. The amount of mortgage debt outstanding on March 25th, 1908, was £135,927, and the amount in the sinking fund at the same date, £3 988 5s. 8d.

Telegraph (Construction) Bill.—Mr. Harold Cox has given notice of his intention to move on the second reading of the above Bill that it is undesirable to give larger powers to the Post Office until the House has been placed in possession of fuller information as to the financial results of the management of telegraphs and telephones by the Post Office. Mr. Courthope, Mr. Geo. Gibbs, and Mr. Lane Fox will move the rejection of the measure.

The Telegraph Service.—Replying in the Parliamentary papers on Tuesday to questions raised by Mr. Jowett as to the transmission of Press telegrams, the Postmaster-General stated that he saw no reason for appointing a Select Committee to consider the present position of the telegraph service.

Manchester Corporation Bill.—Colonel Seeley's Select Committee of the House of Commons has passed the preamble of the Bill promoted by the Manchester Corporation, which extends the boundaries of the city to take in Gorton. By the Bill the tramways in Gorton are vested in the corporation, and the Levenshulme Electric Lighting Order, 1897, and the Gorton Electric Supply Order, 1897, are repealed.

Metropolitan Electric Tramways Bill.—Petitions have been deposited by the Grand Junction Canal Co, the London County Council, Frederick Walker, and the Middlesex County Council in opposition to the above Bill, when it comes before a House of Commons Committee.

BUSINESS NOTES.

Metallic Wall Paper.—An electrical process has been invented by Mr. Sherard Cowper-Coles for making metallic wall paper in continuous lengths, at a price that enables the new product to compete with other embossed and stamped materials for wall and ceiling decoration. The new "paper" has a true metallic surface; that is, it is composed of thin metallic foil, usually copper, not a composition coated with metallic paint. Other metals are sometimes combined with the copper when considerable contrast is required. The paper is practically made in one operation from crude metal, in continuous lengths. In some cases it is backed with paper, in other cases it is applied direct to the wall by means of a special cement. The advantages claimed for the new wall paper are that it is damp-proof, fire-proof, economical and far more sanitary, artistic and durable than any existing wall paper, and it is especially suited for railway carriage fittings, cabins and damp walls. Beautiful colours and effects are obtained by the new process, and the texture of the finest fabrics can be reproduced. The samples before us are very effective.

To Wiring Contractors.—Mr. R. A. Chattock announces that the Birmingham Electric Supply Department is drawing up a list of wiring contractors who are authorised to carry out work in the city area. After June 30th installations to be connected to the public mains have to be carried out by authorised contractors. Firms wishing to be put on the list should read the notice appearing in our advertisement pages to-day.

Sirocco Mine Fans.—Among recent contracts booked by Messrs. Davidson & Co., of Belfast, for Sirocco mine fans, is one from the Powell Duffryn Steam Coal Co., Ltd., for a fan which will have the enormous output of half a million cubic feet of air per minute at 6 in. water gauge. This fan, which is of the double inlet type, will measure 154 in. in diameter, and will be direct-coupled to an electric motor. A large number of fans are also on order for other collieries in Great Britain, including a repeat order from Pelton Colliery, where the first Sirocco mine fan was installed. We learn that among the colonial and foreign orders for Sirocco mine fans received during the last month are three from Australia, two for South Africa, one for New Zealand, and one for Japan.

Catalogues and Lists.—Messrs. Archibald J. Wright, Ltd., Leyton Green Road, N.E.—Price list of various automobile electrical accessories and electrical instruments.

The Electrical Co., Ltd., 121-125, Charing Cross Road, W.C.—Eight-page illustrated price list (No. 279), particularising table, ceiling and wall fans, also ring frame and miscellaneous fans, and accessories. Prices stand out clearly in red.

Messrs. Accumulator Industries, Ltd., White Street, Moorfields, E.C.—Twelve-page pamphlet relating to their A.I. accumulators for motor-car ignition and lighting purposes.

Messrs. Venner & Co., 6, Old Queen Street, S.W.—Leaflet illustrating and briefly describing the Venner time switch for incandescent street lighting.

The H.B. Camp Co., 27, Chancery Lane, London, W.C.—Forty-eight pp. illustrated catalogue depicting with very attractive pictures their system of conduits and their laying-in operation. A list of some of the users is followed by a form of specification.

The British Grille Water-Tube Boiler Co., Craven House, Kingsway, W.C.—Circular giving some illustrations of and information concerning the "Grille" boilers, a good number of which are in service in French electrical works and in the French naval and marine service.

Mr. Chas. E. Miller, Reade Street, New York.—1908 price list (208 pages) of a great variety of automobile and motor-boat supplies.

Messrs. James Simpson & Co., Ltd., 101, Grosvenor Road, London.—Very finely produced catalogue (76), in which they describe and excellently illustrate various types of their pumping engines (including some electrically-driven examples) for water works, sewage works, collieries, &c. Tables are given of fly-wheel pumping engines constructed since 1850, and of Worthington pumping engines constructed since 1886. Steam superheaters and metallic packing are also referred to at the end of the book.

Mr. F. J. Down, 6, Crutched Friars, E.C.—Leaflets relating to foundation cushions for preventing vibration from moving machinery.

Messrs. Thermit, Ltd., 27, Martin's Lane, Cannon Street, E.C. —Several new publications have been received. No. 4 gives illustrated information concerning the company's patent Alumino-Thermic welding process and its applications to repair work; No. 8 relates to the applications of the process to foundry practice; while No. 15 is concerned with the subject of Alumino-Thermics and their application to engineering and metallurgy.

Book Notices. — *Die Isoliermittel der Elektrotechnik.* By Karl Wernicke. Brunswick: Fried. Vieweg. Price 5 M. 50 pf. —Books wholly devoted to the study of insulating materials are still scarce, in spite of the importance of the subject, and the fact that a large mass of recent experimental work is available in the technical papers. The present book, which forms Volume X of "Elektrotechnik in Einzel-Darstellungen," will be found to fill a distinct gap by giving a clear and fairly complete account of (1) the requirements which insulating materials have to satisfy in modern electrical apparatus; (2) the methods of testing these materials; and (3) the nature, methods of manufacture, &c., of some 30 or 40 well-known insulating substances, both solid and liquid. The facts are fully illustrated by the writer's own experiments, as well as by the most recent published results of other workers in this direction. The experimental results indicate that it is still impossible to compare different insulating materials on any strict numerical basis, partly because of the varied nature of the mechanical stresses which the different classes of insulators have to withstand, and partly because of the difficulty of getting concordant results in even the simplest tests on them. The most definite criterion is the breakdown voltage, but even this depends greatly on the conditions of test, shape of electrodes, length of application, &c., whilst other qualities, such as the effects of heat or moisture on the insulating power, are still more erratic. The writer, however, in all cases outlines simple and generally-accepted methods of test by which a reliable idea of the behaviour of an insulator under its various working conditions can be obtained. The book concludes with a separate chapter on insulators for overhead lines treated chiefly from the German point of view. The index could be considerably increased with advantage.

"Atti della Associazione Elettrotecnica Italiana." Vol. XII. January-February, 1908. Milan: Tipo-Lit. Rebeschini di Turati e C.

Prepayment Meters. — The Aron Electricity Meter, Ltd., 80A, Salusbury Road, Kilburn, London, N.W., have introduced a reliable prepayment meter which has now been approved by the Board of Trade, and which, we are informed, is the only prepayment meter approved for alternating current. The meter consists of the Aron induction motor meter (approved by the Board of Trade in January, 1906), combined with a prepayment mechanism. The meter is operated by inserting a coin and turning a knob, thereby closing the switch, and also registering on two dials, one giving the number of coins inserted, and the other showing the quantity of coins unused. These dials are in addition to the ordinary meter dial, which indicates the exact units consumed, thus providing a complete check on the collector. A special feature of the prepayment device is that the turning of the handle supplies the necessary power for working the prepayment gear, so that no power is required from the meter. This is very essential, as at small loads the motor-meter is not powerful enough to operate the prepayment gear, thus allowing the consumer to obtain many units without payment. The meter has been carefully designed to prevent the possibility of its being tampered with in any way. Should it be necessary to alter the price per unit, two change wheels only will have to be altered, which will not affect either the meter or the prepayment gear. The meter can be arranged for all amperages, voltages, periodicities, coins, and any price per unit.

Metal Filament Lamps.—The E.M.F. Manufacturing Co., of 10, Ironmonger Lane, E.C., inform us that they are now able to supply lamps up to 250 volts, for D.C. or A.C., to burn in any position, of 50 and 100 C.P. The efficiency is 1·2 watts per candle, and the average life 1,000 hours, though instances are reported of these lamps burning for over 1,350 hours without blackening or loss of efficiency.

Trade Announcements.—Messrs. Everett, Edgcumbe & Co., Ltd., owing to increased business, have made considerable extensions to their works at Hendon, and have added to the *personnel* of the company. Mr. Patrick Hamilton, B.Sc., A.M.Inst.C.E., M.I.E.E., formerly manager of the electrical department of Messrs. Kelvin & James White, Ltd., has joined the board, and he will take an active part in the supervision and design of the company's various products, and in the management of the business generally. Mr. Hamilton will be located chiefly at the company's Westminster offices, 87, Victoria Street, S.W.

Messrs. Turners & Manville, Ltd., of 5, Lloyd's Avenue, E.C., have been appointed sole agents for "Deltabeston" magnet wire for Europe, and they will send samples and particulars on application.

Mr. J. F. B. Vandeleur is now in business at Toronto (3, Dineen Building) representing Messrs. Evershed & Vignoles. He is also making arrangements with additional firms.

Messrs. William McGeoch & Co., Ltd., of 28, West Campbell Street, Glasgow, and Birmingham and London, now represent the Credenda Conduits Co., of Birmingham, for their C.C.C. conduit fittings and accessories, for Scotland. Messrs. McGeoch hold large stocks for immediate delivery.

The business of Laidler & Co., lately carried on by Mr. W. C. Laidler, at Nutsford Vale Works, Longsight, Manchester, has been acquired by Messrs. Laidler, Ritchie & Co., Ltd, who will attend to accounts. The business, which has now increased manufacturing facilities, will be managed by Mr. Laidler and Mr. Thomas E. Ritchie, as managing directors. Mr. Ritchie was for more than six years business manager to Messrs. Royce, Ltd., of Manchester.

Messrs. Schoen Bros., of 29, Cock Lane, London, E.C., announce that they have taken charge of a Continental agency for telegraph tape.

Dissolutions and Liquidations.—Kevan Electric Co., Ltd., and Kevan Signs, Ltd.—Both of these companies are winding up voluntarily with Mr. Edmund Heisch, 120, Fenchurch Street, E.C., as liquidator, to whom particulars of debts, &c., must be sent by June 3rd and 5th respectively.

Monobloc Accumulator Syndicate, Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. H. Newson-Smith, 37, Walbrook, E.C., by May 30th.

Electric Safety Appliances Co., Ltd.—A meeting is to be held at 82, Victoria Street, S.W., on May 26th to hear an account of the winding up from the liquidator, Mr. H. A. Grimsdick.

The "Bandy" Motor.—Messrs. Bergtheil and Young, Ltd., of 12, Camomile Street, E.C., have recently put on the market a new single-phase alternate current variable speed motor (the Bandy), which they claim to be capable of developing a starting torque equal to twice full load running torque, or even higher, and of running at any speed for any length of time. Some details of the motor and of their push button controlling system are given in some leaflets just issued, and of which we have received copies. The motor is stated to be specially suitable for driving printing presses, callenders, calico-printing machinery, machine tools, electric lifts, and organ-blowing equipments.

LIGHTING and POWER NOTES.

Acton.—Sir Alex. B. W. Kennedy has been appointed by the U.D.C. to advise upon its electricity undertaking, at a fee of 100 guineas.

The electrical engineer recently reported that the electricity department had laid 4¾ miles of distributor at a cost of £2,949 18s. 9d., or 7s. 2½d. per yd. (for which work the St. Helens Cable Co. quoted 9s. 11d. per yd.); that these extensions of cable had enabled 369 consumers to be connected, who have used 113,800 units and paid the Council £1,924 4s. 1d. and that the annual repayments on these cables is £421 19s. The Electricity Committee noted with satisfaction the saving effected by using direct labour.

Barking.—At a L.G.B. inquiry into the application of the U.D.C. to borrow £27,000 for purposes of electric lighting, it was mentioned that there are now 3,045 customers and 1,445 street lamps, and there are 62 oil lamps in the Beehive and Barkingside districts which are to be replaced and supplemented by electric lamps. Next winter the additional plant will be required.

Barnstaple.—The Electric Lighting Committee of the T.C. is now in a position to grant a rebate of 10 per cent. on the cost of public lighting in the town. This will prove a great satisfaction to the ratepayers, as it has been agitated for, for a considerable time.

Bexley.—At the last meeting of the U.D.C. the Electric Lighting and Traction Committee reported that it had had under consideration the desirability of instituting an alternative daylight tariff for supply to motors, and recommended the following scale:—From 0 to 2,000 units per annum, 3d. per unit; from 2,000 to 2,500, 2¾d. per unit; from 2,500 to 3,000, 2½d. per unit; from 3,000 to 3,500, 2¼d. per unit; above 3,500, 2d. per unit. Minimum charge, £2 13s. 4d. per annum, and charges to be net. Meter rents to be charged in addition, at the same rates as on the existing daylight tariff, and the new tariff to be governed in all other respects by the regulations applying to the former. The report and recommendation were adopted.

Brighouse.—A loan of £3,600 for electricity purposes has been applied for by the T.C.

Canada.—There is a well-defined rumour in the Ontario Legislature that upon application by Toronto and other municipalities for power, Premier Whitney proposes to create a Department of Power to superintend the expenditures necessary for the transmission and the administration of the whole policy of power. It is understood that the Government has decided to build transmission lines through Western Ontario at least, and probably also to Toronto. This means a liability of two or three million dollars; it means also precise business contracts with the munici-

palities. An Electric Power Department is certainly something novel in the political situation, in this or any other country; and the fact that the Province of Ontario may be the first Government to create an Electric Department merely goes to show the great progress which has been made in electrical development.

TORONTO.—The financial statement of the Toronto Electric Light Co. shows that from 1884, with an authorised capital of $200,000 and a paid-up capital of $175,000, the company has grown, until in 1907 it had an authorised capital of $4,000,000 and a paid-up capital of $3,385,477.29, on which it has paid dividends of 8 per cent. The contract price for electric lighting in Toronto was, in 1884, $226 per light per annum; and in 1906, it had been reduced to $69 per light per annum. The average price of light for small users is 12 c. for commercial and 8 c. for house lighting. While this is not high, it is higher than in many Ontario towns. In Ottawa the price is 12 c., with 40 per cent. off; in Pembroke it is 8 c.

Continental Notes.—AUSTRIA.—A company has recently been formed at Wogau, Bohemia, to put down plant to utilise certain available water power in the generation of electrical energy for lighting and power purposes in the towns of Wogau, Dreihof and Forba.

Cowdenbeath (Fife).—At a special meeting of the T.C. a letter was read from the Fife Electric Power Co. in connection with the lighting of the burgh. The company made two offers. One was to the effect that it would erect 20 arc lamps, complete, supply the necessary cables and connections, and be responsible for their upkeep, for £12 each per annum. The company also offered to supply electricity for the present incandescent lamp pillars, supply lamp renewals, &c., for 38s. 9d. per lamp per annum (contract to be for 10 years). If after the first year it was found necessary to renew the mains, the cost would be for them £2 5s. per lamp per annum. It was agreed to consider the offers in committee.

Edinburgh.—The estimated ordinary expenditure for the year 1908-9 for the electricity department is £70,293, as against the estimate for the current year of £65,040. The payments to interest and sinking fund contribution in respect of debt are estimated at £56,070, as against £50,065, giving a total estimated expenditure of £126,300, as against £121,105 for the current year. The estimated revenue for 1908-9 is £136,200, as against £132,585 for the current year, leaving a surplus of £9,900, as compared with the estimated surplus for the current year of £11,408. The estimated capital expenditure is £33,090, principally to finish the alterations and additions at M'Donald Road station.

Exeter.—The E.L. Committee has resolved to apply to the L.G.B. for sanction to raise a loan of £8,100 for the extension of the mains.

Greenock.—The question of supplying Port Glasgow has again been under discussion by the T.C. It was decided to continue negotiations, although the Clyde Valley Power Co. alone has power to supply in the area in question at present.

Ilford.—On April 26th a L.G.B. inquiry was held into the application of the U.D.C. for a loan of £27,000 for E.L. purposes. There was no opposition.

India.—The Government of Bengal has sanctioned, with effect from April 1st next, the formation of an electrical public works division, at Calcutta. The electrical division will be under the control of the superintending engineer, Central Circle. Mr. A. K. Taylor, electrical inspector, is appointed to be executive engineer of the electrical division.—*Indian Engineering.*

London.—The Battersea B.C. has decided to install a feeder booster and accessories, at a cost of £1,847, to facilitate the supply of electricity in the Nine Elms district.

Loughborough.—The corporation electrical engineer (Mr. W. H. Allen) has recently issued a small pamphlet drawing attention to the advantages of the electric motor in Loughborough, and we are glad to note that the pamphlet will be followed up by appropriate letters emphasing the importance of the matter, Mr. Allen evidently appreciating the necessity of methodical application to this question.

Maidstone.—A L.G.B. inquiry was held on April 23rd into the application of the T.C. for a loan of £18,440 for electricity purposes. There was no opposition.

Navan (County Meath).—The Urban Council is at present interested in an electric lighting scheme for the town, which latter is situated on the banks of the River Boyne.

Perth.—Incandescent gas lamps for street lighting seem to be doomed in Perth, as at the last monthly meeting of the T.C. it was decided that all the incandescent gas lamps in Marshall Place should be replaced by metallic filament lamps. It was stated at the meeting that the metallic filament lamps, besides being cheaper, gave a greater illumination. There can be no doubt, therefore, that it is only a question of time before the remainder of the incandescent gas lamps for street lighting are superseded.

Rawtenstall.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £34,000 for electricity purposes, the sum being made up as follows:—Generating station and plant, £23,162; cables, £10,733; two 30-KW. static transformers, £105. There was no opposition.

South Africa.—JOHANNESBURG.—At a special meeting of the T.C. regarding the gas engine power plant, which caused considerable trouble, leading to the instalment of steam engines, it was proposed to sell the plant to the sureties for the contractors for £50,000 cash, and £125,000 in debentures in a company to be formed, and to enter into a contract with the new company to supply electric energy at 1½d. per unit, the contract to be continued for ten years. However a deadlock has since arisen in regard to the negotiations between the Council and the sureties, and protracted proceedings resulted in the adoption of an amendment by 15 votes to 13, referring the proposed agreement back for further consideration and to report to the Council in six weeks.—*Cape Argus.*

U.S.A.—A 120,000 H.P. hydro-electric scheme, which will furnish electric power to the cities of Central California is being pushed forward at a point on the Feather River, 19 miles above Oroville. In connection with the work a tunnel 3 miles long and 20 ft. diameter has been driven under the mountains, giving a 540 ft. head at the plant. The transmission lines will run to Oroville, Marysville, Sacremento and Oakland, and will supply energy for pumping plants where irrigation schemes are developing.

Walthamstow.—The U.D.C. has received from the L.G.B. sanction to the borrowing of £17,189 for the provision of additional plant at the generating station, and £222 for an air compressor and weighbridge. The Council, at its meeting on April 24th, decided, on the recommendation of the Rate Committee, that a charge of 1⅛d. per unit be made to the light railways undertaking for the energy consumed during the year ended March 31st last.

Wednesbury.—The T.C. has received from the L.G.B. sanction to a loan of £8,000 for E.L. purposes.

TRAMWAY and RAILWAY NOTES.

Barking.—At the last meeting of the U.D.C. the question of disposing of the tramway undertaking to Ilford or East Ham was discussed, but without result. The tramways resulted in a loss of £7,000 during the past 12 months.

Blackburn.—It is proposed by the Light Railways Commissioners to hold a public inquiry at the Town Hall on May 8th, into the application of the Blackburn, Whalley and Padiham Light Railways Co. for an order for revival and extension of time.

Blackpool.—The annual report on the tramways undertaking states that for the year ended March 31st, 1908, 168,212 fewer passengers were carried than in the previous year, and 15,567 fewer car-miles were run. The income for the year was £53,740, against £56,586 in the previous year, and the disposable balance, after paying all expenses, was £6,410, against £10,042.

Belfast.—The Tramways and Electrical Committee has received a letter from the Cavehill and Whitewell Co. regarding the arrangement suggested at the recent conference between the directors and the Committee with respect to the company's lines. After some discussion, it has been decided to go into the matter fully at the next meeting of the Committee. The suggestion is that arrangements may be made whereby the company's cars will be enabled to run over the Corporation's lines, so as to leave passengers in the centre of the city instead of in the suburbs, the two systems having their termini a few yards apart at Chichester Park.

Brighton.—It is understood that the working of the Corporation tramways will show a deficit of over £1,000 on the year 1907-8. Taking the good and bad years since the commencement of the undertaking, there will be (inclusive of the above) a deficit of £991 on the tramways.

Bury.—At a meeting of the Tramways Committee on Friday, it was reported that the net profit on the Bury sections of the electric tramways for the past year was estimated at £4,606, as compared with £5,225 for the previous 12 months. The manager explained that the falling-off was due to the fact that the financial year just closed did not include any Easter holidays. The capital expenditure on the system has been £242,500. In the first year, 1905, the surplus was £510; in 1906 it was £3,348, and in 1907 £5,225, of which £2,725 went to the relief of rates and the rest to the reserve fund. The Corporation owns 11 miles of track, and leases and works about 8 miles.

Cardiff.—The local branch of the Amalgamated Association of Tramway Workers, numbering about 300, has asked the City Council to approve of the formation of a Conciliation Board to deal with the rate of wages, hours of labour, and other matters which cannot be amicably settled with the tramways manager. The Tramways Committee discussed the matter at its last meeting, when it was stated that the manager and the employés were on most friendly terms, and it did not see the necessity for establishing such a board. However, it was decided to ask for further information.

Continental Notes.—RUSSIA.—Work is well in hand on the conversion of the tramways in the town of Saratov to electric traction. The central power station is completed so far as the building is concerned, and six Diesel engines of 400 H.P. each

are now in course of erection. In view of the possibility of procuring supplies of liquid fuel at a low price, it is confidently anticipated that the cost of power generation will be less than where steam engines or turbines are employed. The horse tramways cover a distance of 16 versts, but the electric system will extend to 45 versts; it is expected that the first line will be put in operation in June next.

Italy.—La Société des Tramways Electriques de la Province de Salerne is constructing an electric tramway between the town of Salerne and the Valle di Pompei. The line will be 30 kilometres long, and will be on the high-tension single-phase system, the transformers being carried on the cars. The construction of the line and of the power station is well in hand, while the rolling stock has already arrived from America and is in course of erection.

Switzerland.—The Federal Council has recommended to the Federal Assembly the adoption of the following projects, viz.:—(1) The construction of a funicular electric railway, of 1 m. gauge, from the Place Léonard, at Zurich, to Susenberg (Zürichberg), a distance of 1,614 metres; (2) the construction of an electric railway of 1 m. gauge, partly cogged, from Brigue to Belalp, a distance of 11,700 metres.

Germany.—The Munchener Elektromobil Betriebs Gesellschaft is the name of a company which has just been formed in Munich to introduce a service of electrical motor-cabs and carriages in that city.

According to the *Standard's* correspondent, one of the Berlin suburban lines has for some months past been run with electric traction, to ascertain by practical experiment whether this is economically practicable. Apparently the experiments have been successful, for it is now announced that the State railway authorities intend adopting electric traction on the longer ordinary lines with both passenger and goods traffic. The lines selected are from Leipzig to Magdeburg, and from Leipzig to Halle, the former having a total length of 80 miles and the latter 23 miles. It is proposed at first to reduce the number of carriages, and to run shorter trains, more frequently than at present.

Devonport.—The Devonport and District Tramways Co. has submitted the following scheme to the Corporation:—(1) The company to institute a universal penny fare by any one car (except beyond St. Budeaux Station to Saltash Passage; (2) the Corporation to forego (*a*) the amount of sinking fund and interest paid by the company in excess of the amount paid by the Corporation; (*b*) the £200 per annum paid by the company as route-mileage rental; (*c*) the £200 annual contribution towards the cost of the Camel's Head Embankment; (3) the Corporation to reduce the price charged for all electrical energy supplied to the company from the present figure of 3d. and 1·4d. to 3d. and 1·2d. from the date on which the before-mentioned universal fare is instituted, the lower price to be further reduced every subsequent year by one-tenth of a penny down to 3d. and ·8d., the company undertaking, in consideration of this immediate and these subsequent rebates, to forego until the termination of this agreement its right to a revision of prices under Major Cardew's award; (4) the Corporation not to oppose the running of Devonport cars into Plymouth, nor of Plymouth cars into Devonport; (5) the agreement to continue in force, unless terminated by either party on three months' previous notice at the end of the first year. On the suggestion of the town clerk, the Committee decided that, as the matter is of great importance, it be considered at a special meeting of the Committee, at which a report on the subject, prepared by the town clerk, will be presented.

Erith.—The U.D.C., having received from the L.C.C. a plan showing the proposed temporary terminus of the L.C.C. tramway at Abbey Wood, is to ask the County Council its reasons for proposing to make the present terminus at a distance of about 80 ft. from the county boundary, and to point out that it is most desirable for the convenience of through passengers that the tramways of the L.C.C. and the Erith Council should actually be joined up at the county boundary, as provided by the L.C.C. (Tramways and Improvements) Act, 1904. The Woolwich B.C. has also protested against the County Council's proposal with regard to the terminus.

Hythe.—The National Electric Construction Co. has intimated to the Council that the delay in proceeding with the tramways is solely due to the financial situation at the present time. The company has already spent over £30,000 on the scheme, exclusive of the Parliamentary deposit.

Liverpool—Southport.—Commencing to-day (Friday) a through service of electric trains will be possible between Southport (Chapel Street) and Dingle, in place of the existing service between Waterloo and Dingle.

Rotherham.—The receipts of the tramways during the past year amounted to £31,653, being 11·53d. per car-mile, which latter compares with 10·45d. in 1906-7. The gross profit was £10,330, and after meeting financial charges, the net surplus amounts to £5,618, which the borough auditor recommends should be employed to make up the deficiency in the renewals fund.

Stalybridge.—In connection with the scheme for connecting Saddleworth and Mossley by electric tramway with the Oldham system, the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board have agreed to supply energy at from 1½d. to 1d. per unit, according to the quantity used. It is estimated that the energy used in the first year would cost less than 1½d. per unit. Moreover a favourable arrangement has been made with the Joint Board for running powers over their system, which has a length of 27 miles. As a temporary measure, the Joint Board have agreed to work the Mossley and Oldham and the Mossley and Waterside sections, supplying rolling stock, energy and staff.

TELEGRAPH and TELEPHONE NOTES.

Mexico.—A company has been organised with a capital of about £100,000 to develop long-distance and wireless telephony between Mexico City and the port of Vera Cruz.

Telegraph Congress.—The congress of the General Association of Posts and Telegraphs was opened at Lyons on the 22nd ult.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed..	Jan. 12, 1906 .. ..
Tarifa-Tangier		Jan. 18, 1904 .. ..
Port Arthur-Chifu (Closed)		Mar. 9, 1904 .. ..
Alexandra-Larnaca		Jan. 28, 1908 .. ..
Cadiz-Teneriffe		April 22, 1908 .. ..
Landlines.		
Puerto-Barrios		Aug. 2, 1902 .. ..

Telephone Employés' Union.—On Tuesday last a meeting of the National Telephone Co.'s telephone operators and employés was held in London to consider the approaching transfer to the State of the company's staff and business, and it was decided to form a union in order to protect the interests of the staff.

Wireless Telegraphy.—The chairman of the German-Atlantic Telegraph Co., at the recent general meeting of shareholders held at Cologne, referred to a newspaper statement to the effect that the danger of the rivalry of wireless telegraphy had affected the share quotations, and he is reported to have remarked that "this spectre of threatening competition by wireless telegraphy no longer existed." The latter system was indeed of the greatest importance, but it would never be in the position of competing with the trans-Atlantic cables. On the contrary, it would rather tend to promote traffic through the cables.

Wireless Telephotography.—On Tuesday last Mr. Hans Knudsen, a Dane, gave a demonstration of his system of transmitting sketches and photographs by wireless telegraphy, at the Hotel Cecil. The system follows usual lines, a travelling point passing over a prepared picture being used to control the sending apparatus, and the impulses received at the other station being conveyed to receiving apparatus which records them in due order on a prepared plate. The inventor claims that the system can be employed over any distance to which wireless telegraphy is practicable, apparently forgetting that long-distance telegraphy can only be accomplished with the aid of the telephone; and he proposes to apply it also to type-setting.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Perth.—September 7th. 650 telephone wall sets, 150 table sets, various switchboards, other instruments, protectors, &c., for the Postmaster-General's department. Some particulars can be seen at the Electrical Review office.

Belfast.—May 13th. Five iron lattice-built electric light masts, for the Harbour Commissioners. See "Official Notices" to-day.

Bermondsey.—May 18th. Boiler, steam dynamo, condenser and cooling tower, for the B.C. See "Official Notices" to-day.

Birkenhead.—May 11th. Small coal for the Corporation electricity works for 12 months. Mr. W. Wyld, borough electrical and tramways manager.

Darlington.—May 11th. One Lancashire boiler and superheater for the Corporation electricity department. See "Official Notices" April 24th.

Derby.—Cable for the electricity department. See "Official Notices" to-day.

Germany.—Tenders are about to be invited for the establishment of a central electric lighting station in the town of Mittweida, Saxony.

Ilford.—May 12th. Feeder cable for the U.D.C. See "Official Notices" to-day.

London.—May 5th. Tenders are invited for new or second-hand cable for the Franco-British Exhibition. See "Official Notices" to-day.

L.C.C.—May 9th and 11th. 175 car-bodies, trucks and equipments; wiring and fitting of Hackney car-shed. See "Official Notices" April 10th.

L.C.C.—May 12th. 3,500 steel tires (31¾ in.) for driving wheels, and 2,000 ditto (21¾ in.) for pony wheels for electric cars. See "Official Notices" to-day.

Manchester.—May 5th. The Tramways Committee invites tenders for hard-drawn copper trolley wires. Particulars from the general manager, Mr. J. M. McElroy.

Portsmouth.—May 6th. Electric wiring and fitting of the laundry at the Infectious Diseases Hospital, Milton. Specifications, &c., at the borough engineer's office, Town Hall.

Rawtenstall.—May 4th. Steel poles, overhead equipment and accessories, for the Corporation. See "Official Notices" April 17th.

Rochdale.—May 6th. Panels for D.C. switchboards for the Electricity Committee. See "Official Notices" to-day.

Rugby.—May 5th. 880 yards paper-insulated lead-covered and armoured service cable for the U.D.C. electricity department. A. Morson, clerk, Benn Buildings, Rugby.

Spain.—May 8th. Public electric lighting of Villarubia de los Ojos for 20 years. Deposit 5 per cent., and local representation necessary.

May 31st.—Electric light and power installation for the Board of Works of the port of Tarragona. Board of Trade, Commercial Intelligence Branch.—*Board of Trade Journal.*

Spain.—Tenders have just been invited for the concession for the establishment and working of a telephone exchange in the town of Villargarcia (province of Pontevedra).

Spain.—The municipal authorities of Gironella (province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of 30 years.

CLOSED.

Acton.—The following contracts for one year were sealed on Monday by the D.C.:—

Callender's Cable & Construction Co.—Bitumen.
Reason Manufacturing Co.—Prepayment meters.
St. Helens Cable & Rubber Co.—Cables.
Perfecta Seamless Co.—Steel conduits.
Venner & Co.—Ordinary meters.
British Insulated & Helsby Cables, Ltd.—Fuse boxes.

Aylesbury.—The U.D.C. has appointed Messrs. E. T. Mackrill & Sons as electricians to the Council for a year.

Bradford.—We understand that the Corporation, after making extensive inquiries, has decided to weld all the joints on the proposed tramway reconstruction, amounting to about 6 miles, by the Thermit process.

Italy.—It is stated that the Rheydt Cable Works Co. has secured, in the face of foreign competition, the contract for the supply of all the telephone cables required by the Italian Post Office authorities during the current financial year. The value of the orders amounts to £28,000.

Harrogate.—The T.C. has accepted the tender of Mr. R. W. Ledger, Harrogate, for meter boards, at £2 8s. and £1 16s. per gross for large and small respectively.

Kettering.—The U.D.C. has accepted the tender of Messrs. Chamberlain & Hookham, Ltd., for meters.

Llanelly.—The directors of the Llanelly Steel Co. have placed an order for new generating plant, comprising two steam dynamos of 200-KW. each, switchboard and power station crane, with Messrs. Wellman-Seaver & Head, Ltd., electrical department, who have placed the order for the dynamos and steam engines with Messrs. Siemens Bros. Dynamo Works, Ltd., and Messrs. Belliss & Morcom, Ltd.

Manchester.—The May-Oatway Fire Appliances, Ltd., of London, have placed with Messrs. Drake & Gorham, Ltd., of Manchester, the contract for wiring for the May-Oatway fire alarm to be installed in Messrs. S. & J. Watts & Co.'s extensive premises, Manchester.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Yates & Thom for a Green economiser, that of Messrs. Chamberlain & Hookham for D.C. meters, and that of the General Electric Co. for A.C. meters.

London.—Last Saturday the Metropolitan Asylums Board accepted the tender (£3,434) of Messrs. W. J. Fryer & Co., of Paddington, for the electrical installation at the South-Western Hospital and Ambulance Station. The following is the list of tenders:—

W. J. Fryer & Co. (accepted)	£3,434	A. Hawkins & Sons	£4,475
Electrical Co., Ltd.	3,700	Perry & Co.	4,496
G. E. Taylor & Co.	3,787	W. G. Cannon & Sons, Ltd.	4,500
H. J. Cash & Co., Ltd.	3,819	A. Arthur & Ure	4,665
W. Barton & Sons	3,825	H. J. Godfrey	4,735
H. & C. Davis & Co., Ltd.	3,838	Wenham & Waters, Ltd.	4,741
J. S. Anderson	3,900	T. Potter & Sons, Ltd.	4,866
Tamplin & Makovski, Ltd.	3,926	A. C. Smith, Engineers (Lincoln), Ltd.	4,957
Lund Bros. & Co.	3,980	F. A. Glover & Co., Ltd.	5,700
C. Pullan	4,028	Laing, Wharton & Cunnington	5,750
Tilley Bros.	4,095	J. H. Taylor & Co.	5,899
Pinching & Walton	4,158	Cox-Walkers, Ltd.	5,995
G. Weston & Sons	4,328		

Engineer-in-chief's estimate, £4,000.

WOOLWICH.—The B.C. received the following tenders for the supply of oil-eliminating plant to the Plumstead electricity works:—

Atkins Filter Engineering and Water Softening Co., £90.
Stanhope Water Engineering Co., Ltd., £160; delivery, 7 weeks.
Harris Patent Feed Water Filter, Ltd., £175; 10 weeks.
Babcock & Wilcox, Ltd., £200; 8 weeks.
Paterson Engineering Co., Ltd., £200; delivery, 2 to 3 weeks.
Wm. Boby, (A) £204, (B) £209; delivery, 7 weeks.
Davis-Perret, Ltd. (accepted), £300; delivery, 4 to 5 weeks.

The Borough Council has received the following tenders for the supply of meters:—

Reason Manufacturing Co.—(*a*) 50 3-amp. size, £1 7s. 6d. each; (*b*) 50 5-amp. size, £1 7s. 6d. each; (*c*) 50 10-amp. size, £1 7s. 6d. each; (*d*) 25 25-amp. size, £2 each; (*e*) 25 50-amp. size, £2 10s. each; (*f*) type of meter, electrolytic; (*g*) total amount of tender, £318 5s.; (*h*) period of guarantee, 5 years; (*i*) remarks, first three sizes only 250-unit capacity.
Reason Manufacturing Co. (alternative tender).—(*a*) £1 15s.; (*b*) £1 15s.; (*c*) £1 15s.; (*d*) £2; (*e*) £2 10s.; (*f*) electrolytic; (*g*) £374 10s.; (*h*) 5 years; (*i*) first three sizes 1,000-unit capacity.
Marples, Leach & Co.—(*a*) £1 10s.; (*b*) £1 10s.; (*c*) £1 12s.; (*d*) £1 15s.; (*e*) £1 4s.; (*f*) amp.-hour meter commutator type; (*g*) £328 15s.; (*h*) 12 months; (*i*) foreign-made meters.
The Electrical Co.—(*a*) £1 9s. 6d.; (*b*) £1 12s.; (*c*) £1 14s.; (*d*) £2; (*e*) £2 5s.; (*f*) amp.-hour meter commutator type; (*g*) £345; (*h*) 12 months; (*i*) foreign-made meters.
Siemens Bros.—(*a*) £1 10s.; (*b*) £1 10s.; (*c*) £1 12s.; (*d*) £2 12s. 6d.; (*e*) £2 15s.; (*f*) amp.-hour meter commutator type; (*g*) £364 7s. 6d.; (*h*) 12 months; (*i*) foreign-made meters.
Chamberlain & Hookham (accepted).—(*a*) £1 16s.; (*b*) £2; (*c*) £2 5s.; (*d*) £3 10s.; (*e*) £2 14s.; (*f*) meter mercury type; (*g*) £432 10s.; (*h*) 3 years.
Ferranti, Ltd.—(*a*) £1 16s.; (*b*) £2; (*c*) £2 5s.; (*d*) £3 10s.; (*e*) £2 14s.; (*f*) meter mercury type; (*g*) £432 10s.; (*h*) 12 months.
British Thomson-Houston Co.—(*a*) £1 16s. 6d.; (*b*) £1 18s.; (*c*) £2 2s.; (*d*) £3 8s.; (*e*) £3 8s.; (*f*) meter commutator type; (*g*) £461 5s.; (*h*) 12 months; (*i*) foreign-made meters.
Charles Lang.—(*a*) £2 4s. 9d.; (*b*) £2 4s. 9d.; (*c*) £2 7s. 8d.; (*d*) £3 3s. 9d.; (*e*) £3 10s. 9d.; (*f*) meter commutator type; (*g*) £510; (*h*) 12 months; (*i*) foreign-made meters.
General Electric Co.—(*a*) £2 15s.; (*b*) £2 15s.; (*c*) £2 17s. 6d.; (*d*) £3; (*e*) £3 5s.; (*f*) meter commutator type; (*g*) £575; (*h*) —; (*i*) foreign-made meters.

The first tender of the Reason Manufacturing Co., the Electricity Committee pointed out to the Council at its meeting on April 23rd, was not comparable with the others. The electrolytic type meters, the Committee reported, were extremely fragile, and as they required to be reset at intervals, it considered that to be a disadvantage. The tenders of Marples, Leach & Co., the Electrical Co., and Siemens Bros. were for meters of foreign manufacture, which had not yet received the Board of Trade's approval. The meters to be supplied by Venner & Co. (for Chamberlain and Hookham) were of a new type, and had not, of course, had an extended trial. Large numbers of the same manufacturers' old-type meters were in circuit in the borough and gave every satisfaction, but the manufacturers claimed further advantages for their new type. In considering the tenders the Committee paid due regard to the question of price in relation to the merits of the respective meters, and from previous experience it was convinced that meters of substantial design were the cheapest in the end.

POPLAR.—The B.C. has accepted the tender of the Horsfall Destructor Co., Ltd., at £17,000, for a "Tub-Fed" destructor plant, on similar lines to those installed at Newcastle-on-Tyne, Leeds, Greenock, St. Petersburg, &c., and very similar to the plant recently ordered for the City of Melbourne. The company has also recently received an order from Messrs. John Brown & Co., Ltd., for a destructor, to be installed at the Rotherham Main Colliery.

ST. PANCRAS.—The Electricity Committee has provisionally accepted the following tenders for coal at the generating stations:—

Charrington, Sells, Dale & Co.—600 to 800 tons "Babbington" large hard steam coal, at 16s. 3d. per ton.
Spenser Whatley, Ltd.—600 to 800 tons "Desford" steam cobbles, at 14s. 11d. per ton.

WANDSWORTH.—The tender of Mr. H. J. Godfrey, of Balham, at £220, has been accepted by the Guardians for new telephones, and for fitting them at the Wandsworth Union Infirmary, St. John's Hill, S.W.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

E. & B. H. Davey, condenser tank, £370.
British Thomson-Houston Co., Ltd., switchboard panel and gear for the new 500-KW. engine and dynamo.
J. E. & S. Spencer, steam pipes, £50 10s.
Aiton & Co., Ltd., exhaust pipes, £315.
Hopkinson & Co., Glenfield & Kennedy, Holden & Brooke, and Dore & Co., valves.
Tudor Accumulator Co., Ltd., positive battery, £369, and £46 per annum for 10 years for maintenance.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Electricity and Tramways Board has recently dealt with the following tenders for a 2,000-kw. turbo-alternator and condensing plant:—

C. A. Parsons & Co.		£7,900
Willans & Robinson, Ltd.	(accepted)	8,350

CONTRACTORS' COLUMN.

Openings for New Business.

ABERDARE.—Alterations to Calvinistic Methodist Chapel at Penderyn; Ten houses. Thos. Roderick, architect, Aberdare.

ABERDEEN.—Fish-curing premises at Provost Mearn's Quay, for J. Thomson. Brown & Watt, architects, Aberdeen.

Alterations and additions to fish-curing premises at Poynernook Road for R. Sinclair. W. F. McRobb, builder, Aberdeen.

Alterations and additions to 55, Union Street, for Lipton's, Ltd.; Shop at Albert Quay for the Great Yarmouth Stores Co., Ltd. Cameron & Watt, architects, Aberdeen.

ABERDEENSHIRE.—Additions for farm steading and houses on Newton estate; houses on Folla estate. Davidson & Garden, 12, Dee Street, Aberdeen.

ABERLOUR.—Extensive additions at the Dowans. Mr. Doig, architect, Elgin.

ABERYSTWYTH.—New Shipwright Hotel, for D. Roberts, brewer. T. Morgan, architect.

Country mansion for J. Davies, solicitor. G. Jones, architect.

ABRAM (near Wigan).—Alterations at the Nevison Inn.

ALLOA.—New school (£8,000). J. Cuthbert, clerk to School Board, Alloa.

ANSTRUTHER.—New Murray Memorial Library.

ASFORDEY (Leicestershire).—Schools. W. A. Brockington, Director of Education, Education Offices, Leicester.

ASHBOURN (Derbyshire).—Four houses in Mayfield Road. A. Key.

ASHTON-IN-MAKERFIELD.—Houses, Whiteledge Green, for Mrs. Bent; Liverpool Road, for Lord Gerard; Lowebank Road, J. Derbyshire; Bryn Road, S. Williams, jun.; Bryn Road, D. Houghton; alterations and extensions, Bryn Co-operative Society.

ATHERSTONE (Warwickshire).—New Gymnasium at the Grammar School (£300).

AYR.—New U.F. Church at Wallacetown. Rev. D. Davidson, Wallacetown.

BAMFURLONG (near Wigan).—New Council School. Lancashire Education Committee.

BANGOR.—Hostel on Penrhyn Estate for the Carnarvonshire and Anglesey Training College Committee (£26,000). Lighting by electricity probable.

BASINGSTOKE.—Conversion of the British Schools into Baptist Church (£750).

BEDDINGTON (Surrey).—Re-erecting factory buildings. J. Clark & Sons, Beddington Brickworks, owners.

BEDFORD.—Houses, The Embankment, for Mrs. G. Mayes; Kingsley Road, for W. Braybrooks; Ampthill Road, for T. Nicholls; Short Street, for A. C. Henman; Campbell Road (A. W. G. Prosser, architect, 90, Kimbolton Road); Castle Road, S. Constant, builder, 186, Castle Road; Clapham Road, F. Corby, builder, 54, Stanley Street; Pemberley Avenue, for T. C. Mason; Pembarley Avenue, P. J. Dunstall, builder, Bromham Road.

BERWICK.—Parochial Hall (£2,000).

BINGHAM (Notts) —Ministers' residence for the Wesleyan Methodists (£1,300).

BIRKENSHAW (Yorks.).—Sawmills, engine and boiler houses. F. Rogerson, architect, 14, Henry Street, Brighouse.

BIRMINGHAM.—Probable rebuilding of gun factory in Loveday Street for W. W. Greener (recently destroyed by fire).

(Moseley).—Church and vicarage in Redlings and Russell Roads, Moor Green. Rev. C. E. Hopton, Moseley Parish Church.

Additions to Foundry Road and Handsworth New Road Schools (£950 and £480 respectively). G. H. Kenrick, chairman of the Birmingham Education Committee.

BISHOP AUCKLAND.—Additions to Workmen's Club and Institute, West Auckland. Kitching & Lee, architects, Blackwellgate, Darlington.

BISHOP'S TEIGNTON (near Teignmouth).—New Wesleyan Chapel.

BLACKPOOL.—Wesleyan Church on Raikes Parade, and Gospel Hall in Central Avenue.

BOURNEMOUTH.—Five houses and shops in Commercial Road for Mr. Newton. James & Sons, architects.

Two houses in Rossmore Road for E. Hunt. E. E. Clarke, architect.

Proposed hall for Holy Trinity Parish (£2,000). Rev. A. S. V. Blunt, vicar, Holy Trinity Church.

BRIDGWATER.—Bandstand for the T.C. Borough surveyor, Municipal Buildings, High Street, Bridgwater.

BRIERLEY HILL.—Sunday schools at Quarry Bank. Rev. T. J. McNulty, Vicar of Quarry Bank.

BRIGHTON.—Parish room at Chapel Royal (£2,200). Rev. S. Penzer, vicar.

BUCKHAVEN (Fife).—Tea-rooms, &c., for G. Brown & Sons, East Wemyss, Fife.

BURSLEM.—New Primitive Methodist Church and conversion of existing one into Sunday school, in Hot Lane. Rev. W. Bennions, pastor.

Proposed technical school for the T.C.

BURTON-ON-TRENT.—Shops for the Burton-on-Trent Co-operative Society.

BURY.—New textile works at Bradley Fold, to be electrically equipped throughout.

CAERPHILLY.—18 houses for the Tonyfelin Building Club. W. G. Young, architect, "Rhianfa," Caerphilly.

CAMBERLEY.—Cottage hospital near the White Hart Hotel, Frimley.

CAMBORNE.—Houses, Laity, Troon, for Enwood & Dennis; Mount Pleasant Road, for T. Haslett.

CARDIFF.—Three houses in Clive Road for W. R. Davies. W. H. Dashwood Caple, architect, 2, Church Street, Cardiff.

CARNARVONSHIRE.—Council elementary schools at Chwilog, Penmachno, Pentreufach and Golan; alterations and additions to schools at Llaniestyn, Leithfaen, Trevor, Clynnog and Criccieth. R. Ll. Jones, county architect.

CHADDERTON (Lancs.).—Houses, Middleton Road West, for John Ogden: Middleton Road West, for H. Crossley; Whitegate Lane, for Joseph Hague; and Middleton Road West, for Ashworth and Taylor.

CHELTENHAM.—Conservative assembly hall.

CLYDEBANK.—Extensions to engineering works for Aitchison & Blair.

COALVILLE.—Proposed secondary school. W. A. Brockington, Director of Education, Leicester.

COLWYN BAY.—Hall and vestries in connection with St. John's Church (£1,000).

CONWAY.—Works for the Wilfley Mining Machinery Co., Ltd., 129-131, Salisbury House, London Wall, E.C.

COVENTRY.—Enlargement of the Coventry and Warwickshire Hospital.

CRADLEY.—Alteration of school at Netherend, and new boy's department and enlargement of girls' school at Colley, for the Cradley Parish Council. E. C. Starling, chairman of the Parish Council.

CRAIL (Fife).—Proposed new U.F. Church. The Minister, U.F. Manse, Crail.

CREWE.—Proposed new schools. Vicar of St. Peter's Church.

CROMPTON.—Residence, Chamber Road, for A. Wild, manager of the Empire Spinning Co.

DARLINGTON.—Important additions to the works of the Whassoe Foundry Co.

DARTFORD.—Extension of Livingstone Cottage Hospital (£3,000).

DARTMOUTH.—New Primitive Methodist School.

DARWEN.—Alteration to the Technical School. R. and W. Knowles, contractors.

DENTON.—Additions to works, Bond Street, for W. J. Bates & Co., Ltd.; houses, Egerton Street, for Thos. Cheetham.

Proposed new Council School. Lancashire Education Committee.

DESFORD (Leicestershire).—Proposed Infants' Council Schools. W. A. Brockington, Director of Education, Education Offices, Leicester.

DINAS (Rhondda).—Judge Williams Memorial Hall and Institute for R. Williams. Evans, Williams & Evans, architects, Pontypridd.

DOVER.—New St. Mary's Parish Hall and Institute.

EAST BARNET.—Mortuary. H. York, surveyor, East Barnet Valley U.D.C.

EASTBOURNE (Hampden Park).—Twenty-eight semi-detached houses adjoining a proposed new street (Brand Road) for the Eastbourne Artizans' and Labourers' Improved Dwellings Co., Ltd. Mitchell & Ford, architects.

EAST GRINSTEAD (Sussex).—Rebuilding the Vicarage (recently destroyed by fire). Diocesan surveyor.

ENFIELD.—Library at the Highway. R. Collins, surveyor to U.D.C.

ERITH.—Forty-eight houses Hurst Road. W. Egerton, architect, 12, Queen's Road, Erith.

FAKENHAM (Norfolk).—New Primitive Methodist Church. A. F. Scott, architect, Norwich; Mr. Tuthill, builder, Fakenham.

FENCE HOUSES (Co. Durham).—Twenty-eight houses for Lambton Collieries, Ltd.

FENNY STRATFORD.—Houses, Park Road, for Mr. Yirrell; and Park Road, for Mr. Tranfield.

FOLKESTONE.—Military female hospital at Shorncliffe. Division Officer, R.E., Shorncliffe.

GLASGOW.—Extension of the Meat Market. City engineer.

Six tenements of dwelling houses. Alexandra Park Property Co.

Extension of Rose Street School. Clerk to the Glasgow School Board.

GUERNSEY.—Dwelling house, engine room, hornhouse and outhouses at Fort Doyle. J. N. Brouard, supervisor of the Harbour, States Office, Guernsey.

HADDINGTON, N.B.—Parish hall (£1,700).

HAMILTON, N.B.—Primitive Methodist Church at corner of Keith and Bourne Streets.

HANLEY (Wellington).—Renovation of the Parish Church. Rev. A. E. Hurst, vicar of the parish.

HANWELL.—Two proposed Churches. Rev. W. M. Farquhar, rector.

HARROGATE.—Business premises, Station Square, for J. T. Hollins; houses, Wedderburn Road, for A. Palmer; Duchy Road and Rutland Road, for D. Simpson; Mornington Crescent, for A. Chippendale, builder.

Extensions to the Royal Baths for the T.C. Borough Surveyor.

HELMSHORE (Lancs.).—Structural alterations at White Horse Hotel. H. Fielding, architect.

HIGHCLIFFE-ON-SEA (Christchurch). — Primitive Methodist Chapel. T. E. Grimes, architect; H. J. & T. W. Arnould, builders, Pokesdown.

HIGH WYCOMBE.—Houses, Roberts Road, for W. R. Butler; Amersham Hill, for C. E. Skull, J.P.; Terry Road, for A. Stacey; Amersham Hill, for H. Flint; Printing Works for Butler & Son.

HOLYHEAD (Anglesea).—Welsh Calvinistic Methodist Chapel (£3,500), lighting by electricity probable. R. Ll. Jones, architect, Carnarvon.

HOUGHTON-LE-SPRING.—Houses, Grasswell, for J. H. Wood; and Fence houses, for J. White.

HOUNSLOW.—Iron building, Zoar Chapel, Staines Road. Rev. J. E. Flegg.

Villas in School Lane. Thos. Hiscock, builder, 181, High Street, Hounslow.

HOVE (Sussex).—Probable rebuilding of furniture stores for Mr. Lewonski (recently destroyed by fire).

HUDDERSFIELD.—Houses at Berry Brow for the Berry Brow Co-operative Society, Ltd. The Secretary.

HULL.—Proposed Mission Hall, in Beverley Road, for the Trustees of the Science Church. M. Lenham, architect, 21, Bond Street, Saville Street, Hull.

Station buildings and station master's house, at Sculcoates, for the North-Eastern Railway Co. W. Bell, architect to the company, York.

HYDE (Cheshire).—Shops for the Hyde Co-operative Society.

Houses, Ledge Lane, for D. Barber; Oxford Road, for F. Gregory; Oldham Street, for J. Chatterton & Sons; Mottram Old Road, for Mrs. Hyde; Godley Hill, for Mrs. Samuel, Oldham.

INVERNESS-SHIRE.—U.F. Church at Kincardine. D. McGregor, builder, Bonar Bridge.

JOHNSHAVEN (Montrose).—New U.F. Church.

KETTERING.—Houses, York Road, for H. Wilmot; Kingley Avenue, for the Co-operative Society.

KIDDERMINSTER.—Girls' secondary school at the Victoria Institute. City architect.

KIRBY MUXLOE (Leicestershire).—Schools. W. A. Brockington, Director of Education, Leicester.

LANGLEY MILL (Notts).—New Baptist Church and conversion of present one into schools.

LEEDS.—Extension of St. Mark's Church, Low Moor.

Probable rebuilding of Webster's tannery; also Wolfson & Co.'s clothing factory (recently destroyed by fire).

LEICESTER.—Enlargement of Robert Hall Memorial Schools. T. Groves, secretary, Borough Education Committee, Leicester.

(Swannington).—Wesleyan church and schools.

LEIGH-ON-SEA.—Town Hall, public offices and other buildings for the T.C.

EITH.—Rebuilding of premises in Ballantyne Road, Junction Bridge for Harkness, Beaumont & Co., manufacturing chemists. Villa in in Stanley Road for E. Walker, Derby Street..

LESMAHAGOW (Lanarkshire).—Higher grade school. Mr. Gilmore, architect to the School Board.

LINTHWAITE (Yorks.).—Houses, Inglefield, for Ewart Cock; Cowlersley Lane, for E. Pearson; Manchester Road, Jovil, for (Lunn and Kaye, architects, Milnsbridge).

LITTLE HULTON.—Twelve houses. G. and J. Seddon, builders, Little Hulton, Bolton.

LANDRINDOD WELLS.—Houses, Pentrosfa, for R. E. Davies; Pentrosfa, for R. H. Page; Cefnllys Road, for W. H. Dean and Mr. Careless.

LLANDUDNO.—Two villas in Roumania Crescent. A. Hewitt, architect, Llandudno; L. Roberts, builder and owner, Llandudno.

LLANSAMLET.—Welsh Calvinistic Methodist Church at Peniel Green. R. Llewellyn, architect, Birch Grove, Llansamlet.

LONDON (Forest Gate, E.).—Additions to 85, Boleyn Road. A. R. Upsdale, surveyor, 738, Romford Road, E.

(Plaistow, E.).—Alterations to 248, Barking Road. Clemens Bros. builders, York Road, East Ham.

(Silvertown, E.).—Addition to manager's house at Crescent Wharf, for Brunner, Mond & Co.

(Battersea, S.W.).—Development of road from Thurleigh Road to Manchuria Road. J. Cobeldick, 110, Stockwell Road, S.W., agent.

(Stratford, E.).—Bottling store. Savill Bros., Leytonstone Road, E.

(City).—Alteration of buildings, Union Street. F. S. Hammond, 63, Fore Street, E.C., architect.

(Stratford, E.)—Additions, &c., to Industrial School. F. & T. Thorne, 266, Manchester Road, E., builders.

(Walthamstow).—Bakehouse, Forest Road. J. J. Kelf, architect, 213, Hoe Street, Walthamstow.

(W.).—Alterations to the Metropolitan Theatre (£9,000). F. Matcham, architect.

(S.W.).—Proposed new buildings for the Institution of Civil Engineers, at the corner of Gt. George's Street and Prince's Street.

(W.).—Buildings in Oxford Street, Wardour Street and Berwick Street. W. Wallis, builder, 207 and 209, Balham High Road, S.W.

(Finchley).—Two houses, Arden Road. C. W. Scott, builder, Finchley.

(W.).—Rebuilding Carpenters' Arms public house, James Street.

(Long Acre).—Premises for Avon India-Rubber Co., Ltd. Prestige and Co., builders, Pimlico, S.W.

(W.C.).—Buildings in Little St. Andrew Street and Great White Lion Street.

(Walthamstow).—Twelve houses, Beech Hall Road. O. H. Watling, builder, 1, Handsworth Avenue, Walthamstow.

(Walthamstow).—Factory and spirit room for Micanite and Insulator Co., Blackhorse Lane.

(East Ham, E.).—Schools in Altmore Avenue for the East Ham Education Committee. R. L. Curtis, architect to the Education Committee, 11-12, Finsbury Square, E.C.

(Woolwich).—Stationmaster's house near Woolwich Dockyard station. R. and J. Butler, 215, Broadway, Bexley Heath, contractors.

(Woolwich).—Two double houses, Auberon Street, North Woolwich. W. Harris, Steam Joinery Works, North Woolwich.

(Woolwich).—Development of new street. F. E. Windsor, architect, 22, Southampton Street, Bloomsbury, W.C.

(Woodstock Street, W.).—Shop, &c. F. and H. F. Higgs, builders, Station Works, Loughborough Junction.

(Hyde Park Corner, W.).—Super-structure over tube railway station. Coxhead, builder, Leytonstone, E.

(Kensington).—Buildings in High Street. Chinnock, Clarke and Chinnock, agents, 11, Waterloo Place, S.W.

(Hackney, N.E.).—Development of new streets. Gordon & Gunton, architects, Finsbury House, Blomfield Street, E.C.

(Lewisham, S.E.).—Seven houses, Catford Hill. Norfolk & Prior, architects, Catford.

(Chelsea, S.W.).—Wood and iron building. Humphreys, Ltd., contractors, 187-193, Knightsbridge, S.W.

(St. Pancras, N.W.).—Rebuilding of Trinity Presbyterian Church. J. A. Macconald, agent, 7, Arundel Street, Strand, W.C.

(Balham, S.W.).—Shop in Caistor Road. J. H. Beare, builder, 88, Sistova Road, Balham, S.W.

(Victoria, S.W.)—Buildings in Great Chapel Street. Redpath, Brown & Co., Ltd., contractors, East Greenwich.

(Stratford, E.).—Alterations to premises of Richmond & Co., Carpenters Road.

(Stratford, E.).—Sugar warehouse for Boake, Roberts & Co., Carpenters Road, E.

(Silvertown, E.).—Shed for oil storage. Norton Bros. & Co., constructional engineers, Uphall Road, Ilford.

MALVERN.—Alterations and additions to Roslin House, for E. C. Bullock (Broad, Ltd., builders); additions to St. Aloysius, for the Mother Superior (T. W. Holds, architect); mission room at West Malvern, Rev. M. Macdonald, pastor.

MEASHAM (Leicestershire).—Council Schools. W. A. Brockington, Director of Education, Leicester.

MELTON MOWBRAY.—Houses, Cottesmore Avenue, for J. E. Wakerley schools, W. A. Brockington, Director of Education, Leicester.

MIDHURST.—Proposed chapel at the workhouse for the Board of Guardians (£500). J. Knight, chairman of the Guardians.

MILNSBRIDGE (Yorks.).—Houses, Radcliffe Road. J. Ainley, architect, Chapel Street, Staithwaite.

Houses, Cowlersley Lane. Lunn & Kaye, architects, Milnsbridge.

MONIKIE (Dundee).—Extension of Public School. J. S. Langlands, architect, Dundee.

MONK BRETTON (Yorks.).—Houses and shops, Barnsley Road, for J. Bradbury, Barnsley; and houses, Burton Lane, for S. Hartley.

MORTLAKE.—Additional municipal offices for the U.D.C. G. B. Tomes, U.D.C. Surveyor, High Street, Mortlake, S.W.

MOTHERWELL (N.B.).—Council Chambers at Dalziel. A. Bryden, Clerk to the Parish Council, Council Offices, Motherwell.

PEVENSEY (Sussex).—Covered stand (hold 4,400) for the Historical Pageant Committee. F. G. Cooke, architect, 2, Hyde Gardens, Eastbourne.

PLYMOUTH.—Offices and workshops, A. N. Coles, builder, New Town Chambers, Plymouth; houses, R. Huggins, builder, 2, Kingsley Road, Plymouth; houses, R. Gay, builder, 189, Beaumont Road, Plymouth; villas, Pearn Bros., builders, Gilwell Street, Plymouth; shop, J. H. Endean, builder, 10, Notte Street, Plymouth; villas, T. Tellam, builder, 18, Elm Road, Plymouth; houses, J. L. Pethick, builder, 25, Riga Terrace, Plymouth.

PORTSMOUTH.—Rebuilding of business premises, Commercial Road, for Geo. Haines. Cook & Tutte, architects, 394, Commercial Road, Portsmouth.

Church in Stubbington Avenue. Rev. J. H. G. Randolph, Vicar of St. Mark's, North End, Portsmouth.

Place of worship in Stoke Road for the Avenue Road Baptist Tabernacle congregation.

E.L. installation at Infectious Diseases Hospital, Milton, for the T.C. Borough engineer.

RAMSGATE.—Enlargement of the Council Chamber at Albion House for the T.C. (£440).

RAWTENSTALL.—Additions to Whitewell Slipper Works, Waterford, for J.H. Hirst; extensions at St. James-the-Less Roman Catholic school; Mission Church, Wood Top, for Sir W. H. Finney.

RHYL.—Rebuilding the Wesleyan Chapel at St. Asaph.

RUGBY.—Two houses in Manor Road for A. J. Shillitoe.

ST. AUSTELL.—Two residences at St. Dennis, for W. T. Martyn, Naupean, St. Stephens; four houses at Stenalees, St. Austell, for R. Richards & Son, Trethowell, St. Austell.

Two villas at St. Stephens for G. S. Richards, St. Stephens. Mr. Jury, architect, St. Austell.

Two houses at St. Mewan for E. B. Vian, Trelowth, St. Austell; four houses at Stenalees for W. T. Lovering, The Grove, Charlestown, St. Austell. Mr. Mutton, architect, Charlestown, St. Austell.

SEAFORD (Sussex).—Passenger station for the L.B. & S.C. Railway.

SEATON (Devon).—Residence for Miss Smith. E. H. Harbottle & Son, architects, County Chambers, Exeter.

SEDGELEY (near Dudley).—Mission Church at the Straits. Rev. T. G. Swindell, vicar of the parish.

SILSDEN (Yorks).—Reconstruction of premises for the Bank of Liverpool, Ltd. R. Armistead, 8, Charles Street, Bradford, and W. G. Smithson, 13, Bond Street, Leeds, architects.

SKEGNESS.—Lindsey County Council Elementary School. Scorer & Gamble, Bank Street Chambers, Lincoln, architects.

SLOUGH.—House, White Hart Road, for A. Keen; house and stables, Victoria Road, for A. Woolsey; new public house, Salt Hill, for Nevile Reid & Co.

SOUTHAMPTON.—Reconstruction of part of town quay and warehouse for Southampton Harbour Board. E. C. Poole, engineer to the Board.

SOUTHEND-ON-SEA.—Two houses in Southborne Grove, for J. R. Smith; four houses in Sunningdale Avenue, for Dr. Vallance; two houses in Boscombe Road, for E. Leaney; two houses in Glenwood Avenue, for E. E. Everitt; two houses, corner of Westborough Road and Hainault Avenue; two houses and shops in Westborough Road, for W. Squire; six houses in Beedell Avenue, for J. T. Overall; house and studio in Leigh Road (east), for Bailey & Bullen; house and motor house in Drake Road, for G. H. Thorby; bungalow and stable in Southchurch Road, for W. V. Wilson; two houses on London Road, for Scott & Willerson; five houses in Southchurch Road, for C. Cooke; houses, Drake Road, for G. H. Thornby; Drake Road, for Mrs. E. Brittain; Drake Road, for Mrs. H. Ives; Southchurch Road, for W. V. Wilson, auctioneer, 65, London Road.

MULTYFARNHAM (Westmeath).—Alterations and improvements at the Franciscan Abbey. A. Scott & Son, architects, 49, Upper Sackville Street, Dublin.

NANTWICH.—Four houses in Crewe Road, Wistaston.

NEWBURN (Northumberland).—Twelve houses at Westerhope for J. Bainbridge. G. T. Wilson, architect, 22, Durham Road, Blackhill.

NEWCASTLE-UNDER-LYME.—New Sunday Schools for St. Paul's parish; gift of A. F. Coghill, J.P.

NEWHAVEN.—Improvements in the lighting of the Burgess Hill London Road County Council boys' school; also new infants' school under consideration.

NORTHUMBERLAND HEATH (Kent).—Vicarage in Collier's Lane in connection with St. Paul's Church. Rev. H. W. Watson, vicar of St. Paul's.

NOTTINGHAM.—Vicarage in Windmill Lane for St. Luke's Church, Carlton Road.

Recreation rooms at the Sherwood Rise and Bulwell car-sheds for the Tramways Committee. A. Brown, city engineer, Guildhall, Nottingham.

Alterations and additions to St. Mary's Church (£7,000). H. Fowler, architect.

OAKTHORPE (Leicestershire).—Enlargement of schools. W. A. Brockington, Director of Education, Leicester.

OKEHAMPTON (Devon).—Extension and alteration at the workhouse for the Board of Guardians. F. J. Worden, architect, Okehampton.

OWLERTON (near Sheffield).—Hall for the United Methodists (£3,000). J. A. Booker, secretary.

OXFORD.—Wesleyan Methodist Church in New Inn Hall Street.

Alterations and extensions to James Street Police Station for the Corporation. Estates Surveyor, Town Hall, Oxford.

STAFFORD.—Four houses in Ash Terrace, Fillington, for A. Cox; two houses at Doxey, for I. J. Owen, Mynors Street, Stafford.

STAINES (Middlesex).—School, West District Road, Ashford. Architect, Education Committee, Middlesex Guildhall, Westminster, S.W.

STOCKTON-ON-TEES.—Houses, Rokeby Street, for Wm. Little; Allendale Road, for Wm. Weir; Stavordale Road, for A. J. Cooke.

SWANSEA.—Business premises and offices, Wind Street, for Fitt Bros. and Davies. J. S. Andrew, architect, Rutland Street, Swansea.

SWINDON.—Houses, York Road, for Mrs. J. E. Bell; Fairview, for G. Barker; Okus Road, E. Hill, builder, Montagu Street; Kingshill Road, for W. J. Rogers; The Mall, E. H. Bradley, builder, 37, Goddard Avenue.

TAMWORTH.—Extension to Tamworth Grammar School, for the Governors (£300).

TAUNTON.—Probable rebuilding of drapery and millinery premises for E. Love and Sons.

TEDDINGTON.—Additions to St. Alban's Church. Rev. A. M. Cazalet, Vicar.

THORNABY-ON-TEES.—Houses, Victoria Road, for Sidgwick Bros.; and Ellerburn Street, for E. Harrison.

THURLSTONE.—Proposed Council Offices. E. W. Dyson, architect, 10, Regent Street, Barnsley.

TILBURY (Essex).—House and shop, Dock Road, for Mr. Chandler; ten cottages, Orsett Heath, for R. Matthews, 17, King Street, Gravesend.

TROON (N.B.).—Two double villas in St. Meddan's Street, for H. Shaw (£2,200).

TUNSTALL (Staffs.).—Electric lighting of Christ Church under consideration (£50). Rev. D. H. Briggs, vicar of Tunstall.

Large factory for the Grindley Hotel Ware Co.

TURRIFF.—Garage at Messrs. Shearer's works.

TYNEMOUTH.—Alterations and additions to the workhouse for the Tynemouth Union. H. Gibson, architect, 55, Camden Street, North Shields.

PHOLLAND (near WIGAN).—Three houses at Roby Mill. J. Forshaw.

WALKDEN.—Bakehouses in Walkden Road. L. Pendlebury, Hodge Road, Walkden.

Extension to Whittlebrook Wesleyan Sunday School. Trustees.

Villas in Walkden Road. B. Wallwork, Brackley Street, Farnworth, Bolton.

WARWICK.—Extension to Warwick King's High School (£1,200).

WATFORD.—Shop and offices in Addenham Road. J. Rodwell, builder, Bushey Hall Road, New Bushey, Watford.

WEST BROMWICH.—Refuse destructor at the Electricity Works, Black Lake. A. D. Greatorex, borough engineer, Town Hall, West Bromwich.

WESTON (CHESHIRE).—Enlargement of Weston School for the Cheshire Education Committee.

WESTON-SUPER-MARE.—Additions to Whitecross Road Church. J. S. Wilde & Fry, architects, Boulevard Chambers, Weston-super-Mare.

WHITCHURCH (MON.).—Proposed young men's institute (£1,400).

WHITEFIELD (LANCS.).—New secondary school (£15,000). Lancs. County Education Authority.

WHITEHAVEN.—Probable rebuilding of Walker's tannery, Scotch Street (recently destroyed by fire).

Extension of works for W. H. Moss & Sons, Ltd., printers, &c. Sheffield.

WIGAN.—Houses, Billinge Road, Pemberton, for Wm. Lea; Kenyon Road, for J. Walkden; Northumberland Street, for A. Sharples; Warrington Road, Goose Green, for Wm. Liptrot.

WIGSTON MAGNA (LEICESTERSHIRE).—Cookery room at the Council Schools. W. A. Brockington, Director of Education, Leicester.

WILLINGDON (SUSSEX).—New Church, St. Mary's. W. Hay-Murray, architect; M. Martin & Sons, builders.

WOMBWELL (YORKS.).—Houses, Park Street, for Johnson & Taylor; High Street, for A. W. Lewis; Stonyford Road, for W. Elliott; and Station Lane, for T. H. Jones.

WORTH (near DOVER).—Houses, Deal Road, for Turner & Watts.

YEOVIL.—Houses, Mill Road and Woodland Grove, for Chapman & Co., builders; Talbot Street and West Park, for Mr. Cole; additions to works for Hill & Bill, motor engineers, Kingston.

YORK.—Rebuilding premises for J. B. Inglis & Sons, Coney Street.

FORTHCOMING EVENTS.

To-day's Events (Friday, May 1st).—At 9 p.m. Royal Institution. Discourse on "The Scientific Work of Lord Kelvin," by Prof. J. Larmor.

At 1 p.m. Agricultural Hall, Islington. Municipal, Building, and Public Health Exhibition. Opening ceremony. The exhibition will remain open until May 12th.

Saturday, May 2nd.—Liverpool and District Electrical Association. Visit to the Pearson & Knowles Coppull Coal Mine. 1.45 p.m. train, Lime Street Station.

Monday, May 4th.—At 7.30 p.m. At the Royal United Service Institution, Whitehall. Society of Engineers. Paper on "The Design and Waste and Wear of Wheel Teeth," by Prof. R. H. Smith.

Tuesday, May 5th.—At 3 p.m. Royal Institution. Paper on "The Development of the Modern Turbine and its Applications," by G. Stoney (Lecture II.).

At 8 p.m. At the Common Hall, Hackin's Hey. Liverpool and District Electrical Association. Discussion on J. Maxwell's paper on "Electric Incandescent Lamps."

Wednesday, May 6th.—At 8 p.m. Royal Society of Arts. Paper on "The Gramophone, and the Mechanical Recording and Reproduction of Musical Sounds," by L. N. Reddie.

Thursday, May 7th.—At 8 p.m. Caxton Hall. Civil and Mechanical Engineers' Society. "Abbreviated Formulæ for Structural Engineers," by Mr. E. Fiander Etchells.

At 8 p.m. At the Royal Society of Arts. Institution of Electrical Engineers. Paper on "The Manufacture of Electrical Condensers," by G. F. Mansbridge.

Friday, May 8th.—At 8 p.m. At the Royal College of Science, South Kensington. Physical Society. Paper on "An Examination of the Formulæ for the Grading of Cables," by Mr. C. S. Whitehead.

NOTES.

Pringle's Emergency Brake.—Since the table given in our last issue was compiled, Mr. Pringle has carried out a set of tests at low speeds on level track at the request of certain engineers who saw the other tests. They are particularly interesting when compared with the tests which Mr. Fell disclosed to the Tramways and Light Railway Association in 1906.

Speed. M.P.H.	Stop in feet. Fell's tests. Rheostatic.	Magnetic. Type A.	Magnetic. Type B.	Hand.	Pringle's Skid.
4	9	6	3	7·5	—
4½	—	—	—	—	1 5
5	14	9	4	11·5	—
6	20	12	6	16	—
7	26	15·5	8	22	6 3
8	34	19·5	10	29	—
9	44	24	12	37	—
9½	—	—	—	—	11·3
10	58	28	15·5	46	13·8

Electro-Chemical Notes. — CALCIUM CYANAMIDE DERIVATIVES IN EXPLOSIVES.—Dr. A. Frank, of Charlottenburg, has carried out preliminary experiments into the use of some derivatives of calcium cyanamide (the new fertiliser) as ingredients in high-power explosives. It is well known that modern high-power smokeless powders are somewhat treacherous when kept for any length of time, especially in tropical climates, owing to the possibility of the nitro bodies to which they owe their efficiency being gradually decomposed. Moreover, the nitro bodies do a good deal of harm to the guns, not only heavy pieces of ordnance being injured, but even, according to recent reports from the United States Army, portions of the quick-firing machine guns being actually fused by the heat, and ejected with the shot. Many attempts have been made in the past to overcome these defects, and numerous substances have been proposed for use. For instance, the addition of magnesia or some similar base has been tried, the idea being that it should neutralise the acid produced by the decomposition of the nitro compounds. In order to protect the guns from erosion, materials like urea and guanidine have been used which contain comparatively small proportions of carbon and hydrogen, combined with a high proportion of nitrogen in their molecules. The additions, by evolving large volumes of the inert gas nitrogen, absorb some of the heat liberated, and so reduce the temperature, while nevertheless increasing the propulsive force of the powder. Urea contains 46·6 per cent., and guanidine 71 per cent. of nitrogen, but the latter is so expensive that it is scarcely available for extended use. Dr. Frank has tried nitrodicyanodiamidine, which contains 47·61 per cent. of nitrogen, and also develops less heat on combustion than the urea employed by American powder manufacturers. It may be added that calcium cyanamide can also be used as the raw material in preparing urea and guanidine. In the investigation of a subject like the present, very much time is required before definite results can be obtained, as the effect of time and climate upon stored powder has to be studied. Melamine, which is a very permanent body, possesses a low degree of solubility, and would probably be excellent for the purpose in view if it could be produced at low prices.

PRODUCTION OF CALCIUM CYANAMIDE.—A recent issue of the *Chemiker Zeitung* contained an article by Herr F. E. Polzeniusz, in which the author discussed the greater speed with which nitrogen is absorbed by heated calcium carbide when certain substances are mixed with it. It may be remembered that patents have already been taken out for the addition of calcium chloride or of calcium fluoride to the carbide for the purpose in view, whilst objections have been brought against the use of the former on the ground that it leaves the final cyanamide hygroscopic. Herr Polzeniusz has tried the effect of adding a very large number of different substances to the carbide before treating it with nitrogen, and has found that the absorption is accelerated primarily by the presence of such compounds of calcium as contain no oxygen, and melting at a comparatively low temperature, are partially dissociated by the heat. Other compounds, such as alkali metal chlorides, bromides and iodides, ferrous chloride, &c., apparently only hasten the absorption of nitrogen by leading to the formation of a certain quantity of the corresponding calcium salt. The influence of calcium chloride is easily recognisable at a temperature of 500° C. At 700° C., nitrogen is absorbed very greedily by carbide mixed with 10 per cent. of calcium chloride, and at 800° C., the reaction is almost stormy. The author believes the effect depends upon the formation or existence in the mixture of a fusible calcium salt which partially dissociates in the conditions prevailing. He states that he has already discovered other bodies which act as efficiently during the manufacture of calcium cyanamide as calcium chloride does, and yet are free from the unpleasant hygroscopic nature of that salt. Patents have been applied for to cover their use, and therefore further information cannot at the moment be given.

P. & O. Batti-Wallahs' Society.—On Thursday, April 15th, the Birmingham Local Section of the P. & O. Batti-Wallahs' Society held their first smoking concert, under the chairmanship of Mr. J. P. Kemp, of the Birmingham Electric Supply Department. We learn that a very successful evening was spent, nearly 70 members and their friends being present, which augurs well for the success of the first local section of the society. Any of our readers in Birmingham and the Midlands who may be interested in the matter can obtain all particulars concerning the society from Mr. E. Sheppard, the hon. secretary, 50, Alcester Road, Moseley, Birmingham.

Water for Economical Steam Generation.—When dealing with the question of water softening for steam purposes, many writers pay little attention to the many smaller economies that are brought about by softening. In the *Engineering Magazine* Mr. Wm. Greth takes apparently everything into the ledger balance.

To begin with, a steam boiler fed with water free from scale-forming material and from acidity will last almost indefinitely without cleaning or repairs, whereas a scale-forming water brings into being a numerous progeny of faults. The author sums up no fewer than 11 ways in which bad water causes loss of one sort or another. Briefly enumerated, these are the loss of efficiency of the heating surface; the cost of labour, cleaning heaters and pipes and boilers, this one item alone being more than the interest on the investment necessary to obtain a good water supply for the average steam plant; the loss in spare boilers that are required beyond the allowance with clean water; the cost of boiler compounds as ordinarily used for depositing the scale-forming salts inside the boiler; the cost of repairs due to overheating and pitting; the loss due to unnecessary cooling of a hot boiler which would

have worked steadily on if not fouled with scale. Next there is the reduced efficiency of feed heaters; there is the cost of city water beyond the cost of pumping and softening an otherwise available supply; the cost of tube-cleaning machines; the loss of efficiency and earning power of furnaces and mechanical stokers, and the loss and cost of skimming the surface, and blowing out from the boiler bottom, for a boiler does not of necessity require blowing off if fed with pure water, and it may be stated that boilers fed with the old Longdendale Manchester water never did require blowing off, for the water had no solids in it, and merely required a small occasional dose of soda to correct the humic acid of the peat moor from which the water came.

Scale in a boiler is formed in two ways. Either the water loses, when hot, its power of solution of the scale-forming salts or the water becomes saturated with salts by evaporation, and otherwise very soluble salts crystallise out. Impurities in solution indeed become very quickly concentrated in a busy boiler. Thus a so-called 100-H.P. boiler, holding 1,332 gallons and evaporating 333 gallons per hour of water containing 36 grains of scale-forming matter per gallon will have in four hours 72 grains, and in eight hours 108 grains, and so on. In a year of 300 days such a water will produce 12,360 lb. of scale in the boiler if worked at the rate named. The author does not consider that steam heaters, either of the exhaust or live-steam type, will do more than partially deal with scale-forming matter, because heat alone will not serve to deposit all the solids in the absence of concentration. Apparently the author would often employ jet condensation and use new and softened water for feed, so cutting out all oil troubles.

The author next discusses the operations of water softening and the impossibility of removing all the salts, such, for example, as the soluble residue of calcium and magnesium carbonate and hydrate and the salts of sodium which are so very soluble, and, it might have been added, will in time produce a concentrated solution in the boiler, which must be guarded against by salinometer tests and prevented from becoming excessive by periodical salting or complete blowout. As a rule, if a water be reduced to a scale-forming content of 6 grains per gallon, it will be classable as satisfactory. Beyond this point the article is general, and does not in any sense deal with the technics of the operations of softening.

With boiler waters there is no difficulty in reducing permanent hardness if there is no objection to the production of a lot of sulphate of soda from the converted calcium sulphate. Such a water can also be dealt with by means of the barium salts; but barium salts are dear, and they are poisonous and cannot be used in potable water-softening. Necessarily, thoroughly satisfactory operation involves accurate chemical re-agents, thorough mixture, and an acceleration of the reaction by some admixture of previous sludge to act as a nucleus round which the colloidal precipitate may aggregate and take on crystalline form. Heat also accelerates the reaction, and precipitation is hastened by the gravitation of the old particles of sludge nuclei. Clarification demands space for sedimentation and a final filtration. There will always be a struggle between the advocates of intermittent and of continuous treatment.

A comparison of good pure city water at about 5d. per gallon, a well water unsoftened, and a softened water shows an annual cost, including boiler cleaning, &c., for the first, of £237; for the second, of £219; and for the third, of £138, including depreciation of 10 per cent. and interest at 6 per cent. on the £400 cost of the softening plant. These figures do not include the fuel saving of the working boilers. Another example of a plant with and without soft water shows a coal consumption reduced in the ratios of about 248 : 307; 241 : 300; 213 : 282 and so on, the savings amounting month by month to about 20 and 26 per cent. in coal alone. The water was a bad one with 38·05 grains of solids per U.S. gallon and 35·68 grains of scale-forming matter. It was reduced to a total solid content of 21·11 and of 2·66 of scale-forming matter. As the author says, the softening of a water usually entails no extra labour, so that however academically correct it may be to charge wages against the process, this cost does not really appear in the profit and loss account of an undertaking. In Great Britain, where water from a public company usually costs much over 5d. per 1,000 gallons, the saving due to the use of a soft water will be much greater than in the triple example quoted.

In the foregoing, the figures have all been approximated on the basis of the 10-lb. gallon unless otherwise stated.

A German View of the English Electrical Industry.—The *Elektrotechnische Zeitschrift* reprints the following criticism from the *Deutsche Bergwerkszeitung*:—"The manufacturers of machines and electrical installation material, whose position has been very serious for some months past, find little encouragement in the New Year prospects. A careful investigation of the state of this branch of English industry hardly leads to a favourable view of the future. It is a remarkable fact that, contrary to the experience of other countries, the English electrical industry has never expanded into a really prosperous state. The cause of this is to be found in a number of unfortunate conditions. In the first place, a much longer period of struggle preceded the general introduction of electricity for industrial purposes than was the case in other countries. Then light and power installations were considerably handicapped by legal obstacles. This was especially felt in connection with the laying of cables. The gas interests opposed the operations in every way, and considerably delayed the granting of the wayleaves which are necessary in England before the roads can be opened up. Similar opposition occurred in connection with the electric tramways, and it was only some 10 years later than most of the large Continental towns that London obtained its tramways. It was at one time believed that as soon as the rigid English conservatism had been overcome, a large and rapid advance in electrical matters would occur. A large English company, which had formerly imported its machinery chiefly from Germany, determined, in view of this probable expansion, to take up the manufacture on its own account. A number of smaller undertakings also built factories of their own. The demand failing to reach the expected volume naturally led to over-production and a reduction of prices to almost ruinous values. In addition, the new English industry had to compete with the well-organised German and American firms which, besides being backed by large capital, had the practical experience of many years behind them. The result was naturally unsatisfactory to the English firms. Instead, however, of attributing the pre-eminence of the foreign firms to their better organisation and greater experience, it is customary in England to put the blame for the *fiasco* on to the fiscal system. It is a further disadvantage that the English works are generally comparatively small and compete disastrously amongst themselves. Severe competition is, of course, also noticeable in other countries, but in many cases agreements exist between the various firms which limit the under-cutting, which is a feature of English competition. The need for such understandings is becoming more and more felt in England, and negotiations are now in progress with a view to fixing prices. When such an arrangement is an accomplished fact, more favourable results may be expected, especially as the prices of materials have fallen."

Institution and Lecture Notes.—IRON AND STEEL INSTITUTE.—The annual meeting will be held in London on Thursday and Friday, May 14th and 15th. Among the papers down for reading is one "On an Experimental Electric Furnace for the Smelting of Iron," by Prof. B. Igewsky (Kiev); another is "On the Department of Metallurgical Chemistry in the National Physical Laboratory," by W. Rosenhain.

ROYAL SOCIETY.—The following were among the papers to be read yesterday:—Sir William Crookes, F.R.S., "On Scandium." Prof. E. Wilson, V. H. Winson and G. F. O'Dell, on "The Hysteresis Loss and Other Properties of Iron Alloys under very Small Magnetic Forces." Communicated by Sir William H. Preece, K.C.B., F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS.—The Council has prepared the following list of candidates for nomination to fill the vacancies on the Council created by the retirement under the rules, at the end of the session, of the president, two vice-presidents, five members of Council, one associate member of Council, and the hon. treasurer:—

PRESIDENT.

W. M. Mordey. New nominee.

VICE-PRESIDENTS.

*F. Gill.	New nominees.	Col. H. C. L. Holden, F.R.S.	Remaining in office.
*C. P. Sparks.		Dr. G. Kapp.	

* These members, having served only two years as vice-presidents, are both eligible for re-election for one year in that capacity.

MEMBERS OF COUNCIL.

T. Mather, F.R.S.	New nominees.	S. Evershed.	Remaining in office.
Major W. A. J. O'Meara, C.M.G.		H. E. Harrison.	
Prof. A. Schwartz.		Dr. E. Hopkinson.	
J. F. C. Snell.		J. W. Jacomb-Hood.	
G. Stoney.		J. E. Kingsbury.	
		M. O'Gorman.	
		G. W. Partridge.	
		W. H. Patchell.	
		W. Rutherford.	
		A. A. C. Swinton.	

ASSOCIATE MEMBERS OF COUNCIL.

J. E. Taylor.	New nominee.	J. Hunter Gray.	Remaining in office.
		H. Human.	

* HONORARY TREASURER.

Robert Hammond. New nominee.

* The honorary treasurer retires annually and is eligible for immediate re-election.

Colliery Electrical Plant Destroyed by Fire.—By a fire which originated in the compressed-air engine house at Tankersley Colliery (Newton Chambers) on Saturday last the electric power house was gutted. The plant, which was destroyed, comprised three engines and dynamos, switchboard, &c. A number of the machines in the mine were dependent upon this plant for their driving power.

Marseilles Electrical Exhibition.—This exhibition of electrical appliances was opened on April 23rd in the presence of the foreign Consuls.

Electric Cremation.—It is announced that the Paris Cremation Association has opened a competition in order to obtain plans for an electric cremating furnace. By this means the duration of the period for reducing to ashes the body of an adult is to be shortened to half an hour, but the combustion is to take place without the emission of smoke, and the cost is not to be more than under the existing system. A prize of £60 is offered for the type of furnace judged to be the best.

Appointment Vacant.—Shift engineer for Ayr electricity works (358.).

The I.M.E.A. Convention.—The thirteenth annual Convention is to take place at Nottingham from June 30th to July 3rd. According to the preliminary programme arrangements will be as follows:—

Tuesday, June 30th.—Reception of the members by the Mayor. Presidential address; reading and discussion of papers; luncheon given by the chairman and members of the Electricity Committee; visits to works.
Wednesday, July 1st.—Whole day excursion to Dovedale.
Thursday, July 2nd.—Annual general meeting; visits to electricity and other works; members' annual dinner.
Friday, July 3rd.—Reading and discussion of papers.

The following are some of the subjects to be discussed:—The Experiences of a Convener in Establishing an Electrical Undertaking; The Equipment of a Testing Department; A.C. Accumulator Sub-stations; The Designing of Electrical Generating Stations; Overhead Equipment.

A detailed official programme will be issued later, and in the meantime all communications should be addressed to Mr. C. McArthur Butler, Staple Inn Buildings, Holborn, London, W.C.

Copper.—Copper still remains quiet, and is not likely to suffer from any serious alternations in price at the present rate of supplies. Messrs. Merton's circular gives visible for April 14th 23,702 tons, against 23,265 for end of March, the increase being in stocks at English ports; afloat from Chili 600 tons increase, from Australia 200 decrease. During the fortnight supplies from Spain and Portugal show stronger, Chili and Australia less, America about average.

Scott & Mountain v. Kent Collieries.—On Wednesday the hearing of this case was resumed in the Official Referee's Court at the High Courts of Justice, and was again adjourned.

Franco-British Exhibition.—It is announced that the Franco-British Exhibition is to be opened on May 11th by the Prince of Wales.

Metropolitan Association of Electric Tramways' Managers.—The members of this Association met in conference at the Municipal and County Club, Whitehall, S.W., on Friday, the 24th inst., to receive and discuss the report of their Committee, on matters relating to the licensing of electric cars, &c. It was unanimously decided to press for modification of such clauses of the Metropolitan Public Carriage Act, of 1869, as were deemed necessary for present-day practice. The members subsequently held their usual dinner.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The staff of the Manchester Corporation electricity department have presented a silver tea service to MR. F. H. WHYSALL, resident engineer at the Bloom Street and Dickinson Street stations, on his marriage.

On Wednesday, April 22nd, Miss Gladys Brown was married at the Parish Church, Hampstead, to MR. JOHN G. BRUCE, electrical engineer to the Willesden District Council.

Tramway Officials.—On the occasion of the opening of the extended tramways at Torquay, MR F. O'HARA, the resident engineer of the National Electric Construction Co., was presented by the staff with a gold signet ring and an illuminated address.

MR. T. PARTINGTON has been appointed car-shed foreman of the Falkirk District Tramways Co. On leaving the Blackpool, St. Annes and Lytham Tramways Co., Ltd., he was presented with a case of drawing instruments from the manager and staff.

MR. J. T. CORNISH, M.I.E.E., chief engineer of the La Capital Traction and Electric Co., Metropolitano Tramway, Grand National Tramway Co., Buenos Ayres Electric Tramway Co., Belga Argentina Tramway Co., and consulting engineer of the Cordoba Light and Power Co., has been appointed resident engineer of the City of Santos Improvements Co. (gas, water, electric lighting and tramway), Brazil, and leaves to take up his duties on May 1st. The conversion to electric traction of the Grand National Co.'s system, some 100 miles of single track, was carried out under his supervision. This will not be Mr. Cornish's first visit to Brazil, as he went to the State of Sao Paulo in 1891, and remained some years in connection with electric light construction. He was subsequently engaged in the construction of the first electric tram system in Buenos Ayres some 11 years ago.

General.—In our issue of April 17th, in referring to MR. P. G. GILLARD having left the service of Messrs. Santoni (1906), Ltd., we described him as sales manager to that firm. We are informed on good authority that his position was that of junior salesman.

MR. HERBERT LAWS WEBB sailed for New York on Saturday last per *Lusitania*, partly for the purpose of looking up the latest developments in telephone work, and partly for a change after influenza.

NEW COMPANIES REGISTERED.

Imeson, Finch & Co., Ltd. (97,639).—This company was registered on April 15th, with a capital of £10,000 in £1 shares, to acquire the business carried on at Stockton-on-Tees, as Imeson Bros., Finch & Co., to adopt an agreement with A. Imeson and A. H. Finch, and to carry on the business of electrical, mechanical and general engineers, machinists, smiths, founders, fitters, metal workers, manufacturers of roller controller fingers, roller contractors, automatic cars, trolley heads, lamps, samnite bronze, overhead, electrical equipment and insulators, gear-wheels, and pinions for tramways and railways, &c. The subscribers (with one share each) are:—G. P. Lewis, 38, Portland Road, Hove, civil engineer; J. H. Phillips, 10, Coleman Street, E.C., chartered accountant; A. Imeson, Grange House, Hartburn, Stockton-on-Tees, electrical engineer; A. H. Finch, Eastholme, Ellen Avenue, Stockton-on-Tees, electrical engineer; Major H. Hart, Barnhill House, Stamford; N. White, 6, Great Winchester Street, E.C., financial agent; C. H. Norris, 6, Great Winchester Street, E.C., secretary. Minimum cash subscription, £750. The number of directors is not to be less than two or more than five; the first are G. P. Lewis, J. H. Phillips, A. Imeson, A. H. Finch and Major H. Hart; A. Imeson and A. H. Finch are joint managers, with not less than £250 per annum; remuneration of directors, £50 each per annum, and 5 per cent. of the net profits available for distribution in any year when 10 per cent. is paid on the ordinary shares, divisible. Registered office, 5-6, Great Winchester Street, E.C.

F. Hillier & Co., Ltd. (97,652).—This company was registered on April 16th, with a capital of £1,000 in £1 shares, to carry on the business of exhibition stand fitters, electric light installers, furniture and brass and copper letter dealers, decorators, builders, manufacturers of electrical plant, &c., and to adopt an agreement with F. Hillier. The subscribers are:—J. Robertson, 62, Cotleigh Road, West Hampstead, N.W., cab proprietor, 10 shares; H. Child, 96, Fernhead Road, Paddington, W., works manager, 25 shares; E. E. Ban, Queen's Road, N.W., architect, 1 share; A. North, 6, Melrose Road, Barnes, S.W., gentleman, 1 share; F. Hillier, 89, Malvern Road, West Kilburn, N.W., exhibition stand manufacturer, 1 share; L. Fayolle, 142, Gower Street, W.C., interpreter, 1 share; F. A. Black, 2, Victoria Gardens, Notting Hill, W., journalist, 1 share. No initial public issue: Registered without articles of association. Registered office, 25, Brewer Street, Regent Street, W.

Safety Light, Ltd. (97,692).—This company was registered on April 22nd, with a capital of £150,000 in £1 shares, to adopt a certain agreement (the parties to which are not named), to acquire and turn to account inventions, processes, patents, brevets d'invention, licences, concessions, rights and privileges, and to carry on the business of electrical engineers, producers of electric light or power, gas makers, vendors and suppliers, water supply engineers, founders, tool makers, &c. The subscribers (each with one share) are:—A. Shanks, Bush Lane House, E.C., engineer; D. N. Ritchie, The Holmes, St. Boswell's, N.B., engineer; J. A. Tinling, 16, Finsbury Circus, E.C., chartered accountant; H. M. Carter, St. Ronans, Scarborough, solicitor; A. C. M. Anderson, 16, Finsbury Circus, E.C., accountant; H. E. Smith, 52, Frederick Street, Edinburgh, electrical engineer; L. B. de Laitte, 117, Middlesex Street, E., engineer; E. Walden-Vincent, Swadelands, Lenham, near Maidstone, merchant. No initial public issue. The number of directors is not to be less than five or more than nine; the first are A. Shanks, D. N. Ritchie, J. A. Tinling, L. B. de Laitte, E. Walden-Vincent and one other to be nominated by the De Laitte Gas Machine Co., Ltd. As soon as the Elwell-Smith Petrol Safety Gas Co., Ltd., shall have subscribed for £22,500 of an issue of £40,000 first mortgage debentures, the said D. N. Ritchie, E. Walden-Vincent and J. A. Tinling shall have the right to nominate one other director; qualification (except first directors), £250 shares; remuneration (except managing director), £150 each per annum (chairman, £200) and 5 per cent. of the distributed net profits when 10 per cent. dividend is paid, to be increased to 10 per cent. when more than 10 per cent. dividend is paid, divisible.

Electric Batteries and Carbons, Ltd. (97,710).—This company was registered on April 24th, with a capital of £20,000 in £1 shares, to acquire and turn to account any patents, brevets d'invention, concessions and the like conferring an exclusive right to use any invention by F. J. Gerard and L. Fiedler, and to carry on the business of engineers, electricians, manufacturers of electric accumulators, electric or other motors, motor-cars, omnibuses, vans, carriages, vehicles, locomotives, dynamos and apparatus, &c. The subscribers (with one share each) are:—R. G. Orr, The End House, Cavendish Road West, N.W., gentleman; E. F. Stranack, 5, Atherstone Terrace, S.W., gentleman; L. Fiedler, 1, Grazebrook Road, Stoke Newington, N., electrical engineer; F. R. Graves, 21, Holm Villas, Silver Street Station, Upper Edmonton, N., insurance agent; L. V. Oswald, 615, Salisbury House, E.C., gentleman; L. H. Raw, 615, Salisbury House, E.C., mining engineer; V. C. G. Marden, 34, Daleview Road, Stamford Hill, N., clerk. Minimum cash subscription £100. The number of directors is not to be less than two or more than five: the first are R. G. Orr, E. E. Stranack and L. Fiedler; qualification, £100; remuneration 2 guineas each per board meeting attended (chairman 3 guineas), and 5 per cent. of the net profits after 10 per cent. is paid on the ordinary shares, divisible. Registered office, 709, Salisbury House, E.C.

Havana Telephone Securities Co., Ltd. (97,712)—This company was registered on April 24th, with a capital of £1,000 in £1 shares, to acquire any bonds, debentures, securities, obligations, coupons, notes, scrip, shares, stock or capital of the Havana Telephone Co. (incorporated in New Jersey, U.S.A.). The subscribers (with one share each) are:—W. Hicks, 43, Bedford Row, W.C., solicitor; F. Birch, 123, Gower Street, W.C., solicitor; E. A. Lewis, 38, Rossiter Road, Balham, S.W., clerk; F. J. White, 481, Lea Bridge Road, Leyton, clerk; G. L. Devisse, 17, Pembroke Street, King's Cross, N., clerk; W. G. Dunstall, 2, Norfolk Street, W.C., secretary; F. H. Nicholson, A.I.E.E., 2, Norfolk Street, W.C., engineer. No initial public issue. The number of directors is not to be less than three or more than nine; the subscribers are to appoint the first; qualification, £200 debentures or £10 shares; remuneration as fixed by the company.

Langbein-Pfanhauser Works, Ltd. (97,730).—This company was registered on April 25th, with a capital of £3,000 in £50 shares, to carry on in the United Kingdom and the Colonies the business of electro-metallurgists, electroplaters, electrotypers, manufacturers of and dealers in dynamo machines, electric motors, switches and other electrical apparatus and instruments, makers, grinding and polishing machines, chemicals and electrolytic solutions, &c. The subscribers (with one share) are:—W. Pfanhauser, 17, Hasenauerstrasse Wien XVIII, electro-chemist; Dr. G. Langbein, 10, Thomasring, Leipzig, electro-chemist; Dr. W. Pfanhauser, 13, Schwagrichen Strasse, Liepzig, electro-chemist; Dr. R. Jay, Haydn Strasse 11, Leipzig, electro-chemist; Dr. H. Kissel, 18, Wye Cliff Road, Birmingham, electro-chemist; O. Pfanhauser, 17, Hasenauerstrasse Wien XVIII, electro-chemist; Dr. W. Wurker, 45, Ritter Strasse, Berlin S.W., electro-chemist. No initial public issue. The number of directors is not to be less than two or more than three: The first are Dr. R. J. and Dr. H. Kissell. If Dr. R. Jay ceases to be a director, the Langbein-Pfanhauser Werke Actien Gesellschaft may, so long as they are shareholders, appoint one of their own directors to fill the vacancy; qualification (except Dr. R. Jay and such nominee) £100; remuneration as fixed by the company.

Sylverlyte Electric Lamp Co., Ltd. (97,716).—This company was registered on April 24th, with a capital of £2,750 in £1 shares (1,500 preferred ordinary and 1,250 deferred only), to acquire and turn to account any invention relating to the manufacture of electric and other lamps and any lenses, reflectors, or other accessories used in connection therewith, in particular to acquire the benefit of an invention referred to in an agreement with J. S. Burns, and to carry on the business of manufacturers of electric lamps, reflectors, lenses and other articles, opticians, glass blowers, &c. The subscribers (with one share each) are:—A. Hill, Norfolk Lodge, Enfield, insurance broker; J. S. Burns, The Firs, Chase Bridge, Twickenham, gentleman; S. F. Rumball, Copthall House, E.C., stockbroker; A. H. Skan, 4, Copthall Chambers, E.C., solicitor; F. E. Hodges, 4, Copthall Chambers, E.C., solicitor; N. Richardson, 360, Winchester House, E.C., gentleman; H. A. Wilding, 25, Framfield Road, Highbury, N., clerk. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, 50 shares; remuneration according to profits.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Leicestershire and Warwickshire Electric Power Syndicate, Ltd. (72,274).—Issue on March 16th of £100 6 per cent. debentures, part of series created March 9th, 1907, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £850.

Issue on April 13th of a 6 per cent. debenture for £50, part of series created July 9th, 1907, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £950.

Associated Battery Co., Ltd. (Westminster) (94,179).—Issue on March 21st of £1,075 5 per cent. debentures, part of series created February 26th, 1908, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

Charing Cross, West End and City Electricity Supply Co., Ltd. (29,122).—This company's annual return was filed on March 25th, when 80,000 preference, 80,000 ordinary, 80,000 City Undertaking preference, and 70,000 City Undertaking ordinary shares had been taken up out of a nominal capital of £2,100,000 in 130,000 preference, 130,000 ordinary, 80,000 City Undertaking preference, and 80,000 City Undertaking ordinary shares of £5 each. £5 per share has been called up on the preference, ordinary and City Undertaking preference shares, resulting in the receipt of £1,200,000. £350,000 is considered as paid on the City Undertaking ordinary. Mortgages and charges: £445,736 4 per cent. debenture stock, and £472,000 City Undertaking 5 per cent. debenture bonds.

A trust deed dated March 31st, 1908, to secure £600,000 debenture stock, has been registered. Property charged: The company's City undertaking, constituted by the City of London Electric Lighting Order, 1899, confirmed by the Electric Lighting Order Confirmation (No. 20) Act, 1899, and the assets and money now or hereafter belonging to the said undertaking. Trustees: Union of London and Smith's Bank, Ltd., Princess Street, E.C.

Maxim Electrical Co., Ltd. (London), (84,426).—A charge on the company's undertaking and property, present and future, dated April 2nd, 1908, to secure £500, has been registered. Holders: Barclay & Co., Ltd.

CITY NOTES.

Electrobuses. A copy of the prospectus of the London Electrobus Co., Ltd., reached us just as we were going to press last week, too late for us to do more than merely announce its circulation then. Notwithstanding the fact that yesterday was to be the last day for the receipt of applications for the issue, we believe the matter to be of sufficient public interest to warrant our making a few observations even now.

Without the least reluctance we congratulate the London Electrobus Co. upon the performance of their vehicles on the streets of London, and upon the evidence there is that the travelling public, pedestrians, and property-owners, all prefer them to 'buses propelled by other powers, whether they maintain the old fares or not. But that is not the only evidence that an investor requires in order that he can feel that his capital is going into a sound pot, and is likely for years to come to bring him a reasonable return in the form of dividend. We propose to inquire in what parts of the prospectus, or of the circulars accompanying it, he has satisfactory evidence on these points. We read that the average receipts per Electrobus mile between July 15th and August 31st were 13·1d.; they increased in September to 13·89d., but between October, 1907, and April, 1908, the figures fell, for we are told that the average receipts for the whole period were 13·069d. per car-mile. The company started *with only a few* electrobuses, and these were *gradually augmented* until, with the larger number (11 appear in a photographic view) the average receipts have fallen somewhat. These 11 vehicles have been running over the best possible route in London from a traffic point of view, and at the "old fares" latterly. Now before we get to the matter of working costs, we will consider the question of the earning capacity of 125 additional vehicles, many of which must of necessity ply on routes which are very different indeed from that so far covered, in regard to traffic possibilities. Is it reasonable to suppose that the experience obtained with 11 cars on the best routes can form a safe guide as to what 150 may do over what we may term less fruitful and more precarious routes, with the enhanced competition that they must inevitably have to meet owing to the provision of increased carrying facilities? We note that in one part of the prospectus it is stated that contracts for 125 vehicles, with the right to call for delivery of a further number, have been entered into; on the next page, where an estimate of earning power is set out, 150 omnibuses are reckoned. The Electric Vehicle Co., Ltd. (late the Electric Van, Wagon and Omnibus Co., Ltd.), of West Norwood, will supply the 'buses at £700 each without tires (125 at £700 = £87,500).

The earnings stated above are certified as correct by the company's auditors, but when we try to ascertain the working costs up to date we have no tangible or certified figures to help us. We have to rely upon *estimates*. The estimate of Sir Douglas Fox and Partners, of 9½d. per car-mile for expenses, is adopted by the directors, and shows a profit of 3½d. per car-mile. The company has paid at the rate of 2d. per car-mile for battery maintenance, but maintenance of tires and accumulators is under contract which can only relieve the Electrobus Co. according to the ability of the contractors, the terms and length of period covered by the contract, and the probability or otherwise of its renewal. It is *estimated* that the cost of energy for the increased number of 'buses can be reduced to ·4d. per unit, and it is ascertained that the energy consumption has been reduced by improvements in the design of the chassis from 1·33d. to 1·264 units per car-mile. The company is offering to the public £240,000 in £1 ordinary shares, and as a sop to the applicants for these, they are to have the *right to apply for* one deferred share of 5s. The capital already issued and the present issue will make £300,000 as the total ordinary capital. Now, an electrobus is proved by experience to run 80 miles per day, so that 150 omnibuses running for 300 days per annum at 3d. per car-mile, would give £300 per 'bus per annum; thus we have at our feet, or shall have when the 'buses are on the streets, a veritable Eldorado, producing a net profit of £45,000 per annum. This gives on the ordinary a modest 10 per cent. dividend, which makes our mouths water, and leaves £15,000 to pay a further dividend on the ordinary, and an *annual* dividend of over 100 per cent. on those 5s. deferred shares, which takes our breath away, but which you, oh reader, are patronisingly given the right to apply for if you are good enough to subscribe for 20 mere ordinary. It may be wondered why only 3d. is the figure accepted in the estimate, seeing that the directors state that they have adopted the engineers' figure 3½d., and are so eager to make the possible profits look so large. It ought to be shown here that that 3d. net profit is "to be safely estimated," "after providing for drivers' and conductors' wages, tires, accumulators, electric current, insurance, depreciation, maintenance, renewals, administration and general expenses," and "after allowing for *all contingencies* and an *adequate* sum for reserve." This is indeed an omnibus clause with a vengeance, and we are curious to know what actual figures appear in the promoters' estimates (1) for *depreciation*, (2) for *renewals*, (3) for *all* contingencies (who knows what these are or may be as experience grows?) and (4) an *adequate reserve* (what can be the meaning of *adequate* when you have no means of calculating the probabilities?)

Messrs. Douglas Fox and Partners estimate the *working expenses* at from 9d. to 9½d., "allowing liberally for maintenance, renewals and depreciation." The directors knock off the ½d. from the 3½d. presumably as allowance for administration and general expenses, all contingencies, and adequate reserve. Nobody will be better pleased than the Electrical Review if practical experience shows these figures to be correct.

We note that Sir Henry E. Dering is now chairman of the company, and that Mr. Jacob Atherton has joined the board.

We repeat our congratulations that the electrobus is comporting itself so well in the eyes of the public and is winning its way in their estimation as compared to petrol vehicles with their stench, noise and other nuisance, and we hope that what is occurring goes to prove that electrically propelled vehicles are the thing that London needs; but we do not congratulate the company upon the too sanguine terms in which it has appealed to the public, holding out such extravagant hopes without full and convincing data to back up those hopes. The public, if we are not mistaken, would take more kindly to such an undertaking if it did not pretend to be a gold mine. We may like the electrobus, and we wish it success, but to approve of its prospectus we find it absolutely impossible.

Oldham, Ashton and Hyde Electric Tramway Co., Ltd.

The meeting was held on the 24th ult. at Donington House. Mr. Emile Garcke, in moving the adoption of the report (see Electrical Review, April 24th, page 710), said that the position of the company continued to be satisfactory. During the past year they had carried over 200,000 more passengers than in the preceding year, which represented an increase of about 4 per cent. The net profit of the company was £647 better than in the year before. They proposed distributing the same dividend, viz., 6 per cent., upon the ordinary shares of the company, and to apply the increased profits to improve the financial position of the company. The profit and loss account did not at the first glance show the increased profit which he had referred to, but that was because they had included this year a provision and renewals to permanent way, amounting to £1,716. This was in the nature of a reserve fund, but the directors thought it prudent that such provision should be made annually for the renewal of the permanent way, and that it should be charged against revenue. Therefore it had been included as a debit to profit and loss account. The board were also proposing to make still further provision against a rainy day, and suggested the creation of a reserve fund for the redemption of the debentures, and proposed this year to set aside £500 for that purpose. It would be evident to the shareholders that they had this year put aside very much more than in the preceding year, and he trusted that with the continued improvement of the undertaking, they would be able to make even better reserve funds in future years. One interesting feature in the profit and loss account to which he would like to refer, was the fact that their administrative expenses were gradually coming down. They were able to administer the company at a less cost as the business developed, but of course, on the other hand, their working expenses, including the cost of current, wages, &c., were slightly on the increase. There was no reason, however, to anticipate that they would not show quite as good a result in the coming year.

Mr. J. Vincent Kitchener seconded the motion, which was carried without discussion.

Babcock & Wilcox, Ltd.

Mr. J. Dewrance presided at the annual meeting held on Friday last, and, in moving the adoption of the report (see Electrical Review, April 24th, p. 710), he said that some of their customers fancied that too large profits were made, but such was not the case. The reason why they were able to make such a good profit was that they had a magnificent organisation throughout the world, that the factory had been extended, and that every detail of the machinery had been perfected to such an extent that the company was able to make a profit on prices which their competitors could not even touch. Much of the business was extremely competitive, and it was only on account of the exceedingly well organised arrangement of the company that they were able to make a profit in these competitive branches. The factory had been very well occupied for the first three months of the current year, and they had every reason to believe that the next accounts would not show any very considerable slump as compared with those now presented. Although it was dangerous to prophesy, that was his opinion. They were threatened with a very serious legislative attempt to restrict the output of coal, which was a highly important factor, and he hoped that the legislators would think twice before entering upon so very dangerous a step. Practically every man who was largely interested in coal had expressed the opinion that the Bill, if passed, would be an extremely serious thing for the country, and he trusted it would not pass into law. In addition to the shortage of supply which would result from it, the Act of Parliament would stimulate an enormous amount of commercial disturbance, with strikes in all parts of the country, which could not fail to have a serious effect upon this company, as well as upon others. There had been instances of these dangerous legislative threats being shelved; he hoped it might be the case with this one.

The report was adopted.

British Westinghouse Electric and Manufacturing Co., Ltd.

In the eighth annual report the directors submit the accounts for the year ended December 31st, 1907. They also submit a balance-sheet as at December 31st, 1906, compiled before giving effect to the capital reduction. In the latter balance-sheet are included the transactions of the period from July 31st, 1906 (the end of the previous financial year), to December 31st, 1906. The reasons for altering the date of the termination of the financial year from July 31st to December 31st in each year have been previously explained by the directors. The debit balance on profit and loss account for the period ending December 31st, 1906, was provided for in the reduction of capital, together with other items of loss and depreciation incurred in the past, so far as ascertained up to the time of presenting the petition to the Court.

The results for the 12 months ended December 31st, 1907, show a marked improvement over previous years. The trading profits amount to £92,383 from which fall to be deducted:—Interest on 4 per cent. debenture stock £49,654, interest on temporary loans £14,379, sundry depreciations (not ascertained at time of reduction of capital) £17,009, leaving a balance of £11,341 to be carried forward.

Having regard to the recent writing down of the various assets, it has not been deemed necessary to make further provision in this year's accounts for depreciation in respect of the works and plant. In their circular of January 4th, 1908, the directors referred to the proposed financial plans. In accordance therewith £250,000 (out of £300,000 authorised) of 6 per cent. prior lien debentures have recently been issued at 98 per cent., and have been fully subscribed. The balance of £50,000 will be held in reserve to be used as and when required for the general purposes of the company. The important arrangement with the American companies has been carried out, whereby indebtedness amounting to £186,374 has been liquidated by the transfer to the American companies of shares in the Traction and Power Securities Co., Ltd., at their par value. Out of the proceeds of the prior lien issue, the loans from bankers will be paid off, and a substantial sum added to the working capital of the company. The institution of economies throughout the administration is continuing to have the careful consideration of the directors. During 1907 there was a substantial increase in the volume of the company's business. At the present moment demand is slack, but the company's improved commercial position, both at home and abroad, will enable it to take advantage of any revival in trade.

Cork Electric Tramways and Lighting Co., Ltd.

Mr. A. R. Monks presided on Tuesday at the meeting held at 83, Cannon Street, E.C. In moving the adoption of the report (see Electrical Review, April 17th, page 671), he said that they regretted the reduced dividend, but the reasons were substantially shown in the report. As regarded the tramways, they had had very bad weather, which had affected the income of every tramway in the kingdom. They had also had dear coal, and had applied an exceptional amount toward permanent way and overhead lines. They proposed to write off—thus securing a practically clean slate—the whole of the balance on the river cables. If they took these matters into account, they fully accounted for 1 per cent. off the dividend. With regard to the lighting department, that was again improving, the increase representing 14 per cent., and they had had the best year in the company's undertaking. Apart from the price of coal, they had every reason to believe that things would be better. The new lamps were largely in use in Cork, and although they perhaps rather cut down the amount of current, this would be compensated for by the increased number of consumers they were taking on. The capital account was practically closed.

Mr. W. M. Murphy seconded.

A conversation ensued between Mr. J. B. Concanon and the Chairman and other directors concerning various items in the accounts. Mr. Concanon, who attacked the board at last year's meeting (see Electrical Review, April 5th, 1907, page 569) said that the present balance-sheet showed considerable improvement over the last, for they earned practically more money and had the wisdom to write off a very much larger sum for renewals at the expense of the ordinary shareholders, who were the people who should stand that expense. When the chairman said that the writing off this year was exceptional, he hoped that he did not mean to imply that they were not going to write off in future as much as in the past year, because he understood that the permanent way was not in the best state. As a large preference holder, he relied upon the board to see that a proper sum was set aside in future to meet renewals and repairs.

Mr. Murphy said that he was in Cork a fortnight ago, and went over a good deal of the track, which was in very good order. The pavement was now having attention after the winter wear. The rails were 83 lb. laid on a good concrete bed. Mr. Murphy went on to refer to permanent way difficulties that were being experienced on all tramways, instancing Dublin, where the engineer was packing the rails with a mixture of iron filings and salammoniac making a sort of rust joint, with satisfactory results. As to whether there was any great scope for lighting developments in Cork, Mr. Murphy said that they had to incur large initial expenditure, and wait for results. Their engineer did not advise them to do that at the same rate as previously. They had put in a new 500-kw. Belliss set.

The report was adopted, and the retiring directors were re-elected.

Further conversation ensued and continued after the meeting terminated, Mr. Concanon expressing a desire to withdraw his attack of last year on the chairman.

Wolverhampton and District Electric Tramways Co., Ltd.

The meeting was held on the 24th ult. at Donington House. Mr. S. R. Blundstone, in proposing the adoption of the report (see Electrical Review, April 24th, page 710), said that although the profit was apparently less by £1,000 than in the previous year, the directors had this year adopted the principle of providing for a renewals fund before arriving at the profit. £1,000 had been charged in the profit and loss account for that fund, and a further £500 was recommended to be placed to the reserve fund. Those amounts compared with £1,000 only placed to the reserve and depreciation fund in the previous year. The traffic receipts were more by £1,000 than in the previous year, but the cost of operation, owing to some very heavy repairs, had increased by £400, and

repairs and maintenance together showed an increase of £700. Rates and taxes had also increased. The passengers carried had increased by 280,000, which was very satisfactory considering that trade in Wolverhampton was not good; and the car-miles run were more. During the present year it was not anticipated that the repairs would be so heavy as in 1907. The general expenses also included some items for the new Tividale car shops, which was a large establishment for all the companies; and the subscription to the British Electrical Federation; both of which items had not previously appeared in the accounts. They would notice that there had been considerable delay in the payment of the purchase price of the tramways which the company had sold to the Dudley Corporation. That arose from an appeal to the House of Lords on the question of price. That had now been settled, and the terms of the lease to be granted to them were under consideration.

The report was adopted.

Kalgoorlie Electric Tramways, Ltd.

The directors report that the gross receipts for 1907 were £48,008, as compared with £51,380 for 1906; the net profits were £16,270, against £17,546. There was a falling off both in receipts and profits, owing to the reduction in the number of men employed at mines which have installed labour-saving machinery, and also owing to the smaller number mining on their own account. The cars travelled 650,530 miles and carried 3,052,241 passengers, as compared with 673,544 miles run and 3,220,728 passengers carried during 1906. The decrease in the mileage is accounted for by the curtailment in the running schedules consequent on the reduced number of passengers. The units consumed in 1907 were 930,231 (value £10,659), as against 933,109 (value £10,930) in 1906. The earnings per car-mile in 1907 were 17·63d. and expenses 11·17d., as against 18·22d. earnings and 11·34d. expenses, during 1906. The expenses per cent. of earnings in 1907 were 63·36d., while in 1906 they were 62·24d. The rolling stock, plant and overhead lines have been efficiently maintained. The Trans-Continental Railway Bill was passed by the Commonwealth Parliament, and this all-important work is, therefore, one step nearer accomplishment. The directors record their appreciation of the work done by the whole of the staff in Western Australia. Owing to the depression in the money market, the directors have been able to redeem a larger amount of debenture stock than was anticipated when the company was formed. The directors record the sudden death of Mr. R. C. F. Ogilvie, A.M.I.C.E., whose advice on technical engineering subjects, especially during the construction, was of great service. The construction being now completed, the directors do not propose to fill the vacancy, but to reduce the expenses accordingly.

Marconi's Wireless Telegraph Co., Ltd.

We make the following extracts from the report just issued by the directors, to which we make reference in a leading article to-day. The report is for the period ended September 30th, 1907, and the directors regret the delay in its publication, but state that the postponement was in the shareholders' interests:—

These (the trans-Atlantic) and many other developments have been attained with a capital issue of about 384,190 shares, with the profits which have been allocated to capital account, and by financial engagements amounting in all to £94,264 at September 30th last. On the credit side of the balance-sheet the important share interests in the subsidiary enterprises, which are of the nominal value of £2,394,106, are, together with the patents, set down at only £242,966. "It is not possible at present to make a precise valuation of these assets, but some idea of their value to this company may be gauged by the fact that our holdings represent more than 50 per cent. of the whole issued capital of these companies. The items include practically the whole of the £200,000 share capital of the Marconi International Marine Communication Co., Ltd., representing the Marconi wireless exchange of messages at sea. By the completion of the arrangements now being made by your board dealing with the trans-Atlantic service, there should be an early accession of income to several of these subsidiary companies, with resultant profits, in which your company will largely share."

"When the patents were originally acquired in 1897, communications could only be sent a distance of two miles, but as the result of the work on development since that date, communications are now able to be sent 2,500 miles. In all, the company own over 550 patents. The more recent patents are of great value, inasmuch as they cover for many years important improvements relating to new transmitters and receivers which secure increased speed and improved syntonisation. On the patents are based the licences which are held by His Majesty's Government, Lloyd's, and our associated companies. The British Admiralty are paying £5,000 per annum, for a term of years, for the right of using our system."

Trans-Atlantic Communication.—"The long-distance station at Clifden, in Connemara, communicating with the long-distance station at Glace Bay, in Nova Scotia, was in October, 1907, so far completed as to admit of its being opened for a limited Press service, and in February, 1908, the stations were opened to the public for the transmission of messages between London and Montreal at an inclusive rate of 7½d. per word. A considerable amount of business has already been transacted by means of these stations, and this business is daily increasing. One newspaper in New York stated that it had during five months received dispatches, totalling 68,404 words, 'promptly and efficiently transmitted by the Marconi system.' These stations will be able to cope with a much larger volume of messages when the necessary enlargement and duplication of machinery has been carried out. It is intended to bring up to the same level of efficiency as the Irish-Canadian stations the two long-distance stations at Poldhu, in England, and Cape Cod, in the United States, and when this has been accomplished there will be two pairs of Marconi high-power stations engaged in the trans-Atlantic service. . . . With the duplication of the power plant, and the establishment of landline connections similar to those enjoyed by the cable companies, this company will be able to provide for the public a speedy and thoroughly efficient direct wireless service with America. The company has an agreement with the British Post Office, whereby the latter engages to grant the same facilities for the collection and delivery of messages by the Marconi trans-Atlantic system as those afforded to the cable companies. A similar agreement has been entered into between the Dominion Government and our Canadian company. Up to the present this service has been conducted at speeds varying up to 20 words a minute, but with a comparatively inexpensive modification of certain parts of the existing apparatus, it is expected to attain a speed of 30 words a minute. On the basis of the improved Irish-Canadian service, and of the contemplated English-American service, working the four stations at 12 hours a day at an average net wireless rate of 4d. per word, and at a speed of 20 words a minute, a net revenue (after deducting working expenses) approaching £150,000 per annum is capable of being earned by these four stations. In addition to the total earnings of the long-distance stations at Poldhu and Clifden, the greater proportion of the profits derived from the corresponding stations at Cape Cod and Glace Bay will also pass to this company in the form of dividends, this company holding the majority of the stock in the American and Canadian companies."

Maritime Business.—The maritime service is progressing most satisfactorily, the North Atlantic being covered by a network of wireless intercommunication. The number of steamers using the Marconi international organisation of ship and shore stations has increased, as follows, warships excluded: 1905, 80 ships; 1906, 92 ships; 1907, 118 ships.

The number of words transmitted and received were:—1905, 643,534; 1906, 1,354,549; 1907, 1,868,540. The net receipts by the Marconi International Marine Communication Co. and its associated companies from this source for the same period were:—1905, £13,066; 1906, £27,501; 1907, £37,936.

"The Marconi companies are the only organisations carrying on an international telegraph business of this kind at sea, and the same progressive increase both in ships installed, messages transmitted and received, and in revenue, as shown by the above figures, has been maintained during the current year. On the establishment of this organisation large sums of money have been spent by the Marconi Wireless Companies, and no efforts have been spared to obtain an equally satisfactory and reliable service on ships of all nations. The Poldhu station has been supplying a daily press service to such of the Atlantic liners as are fitted with our long-distance apparatus. The receipts of the Poldhu station during the last two years amounted to over £9,000."

Intercommunication.—"On the establishment of the above organisation the expenditure was necessarily large, and it has been productive of most promising results, but the very success of our efforts in this direction led to foreign intervention. On the proposal of the German Government, the Powers were convened to two successive conferences, the last and most important of which was held at Berlin in the autumn of 1906 in order to frame an International Convention to regulate the use of wireless communication at sea. The effect of this Convention was a proposal made by Germany, and accepted by the majority of the delegates, to make intercommunication between all systems compulsory. Thus the manufacturers of any wireless instrument would be entitled to demand the same access to our wireless exchange as those who used Marconi's system only, even if the said instrument was an infringement of our patents, and this without incurring any of the initial expense we have had to incur in establishing our stations and organising our exchange. A Select Committee of the House of Commons was subsequently appointed to inquire into the matter, and by a majority of one they reported in favour of the ratification of the Convention."

The directors "remain convinced that the working of wireless telegraphy at sea, that is to say, between moving points, can only be efficient if controlled by one central organisation, and in their opinion the rules adopted by your company and the commercial organisation which it has established afford the best means for ensuring this efficiency and practicability. But the majority of the governments do not share this opinion, and this being the case your directors are compelled to take the view that it would be wise for this company's business interests to consider how it may best be found practicable to modify the policy hitherto pursued by the board, and believe that with mutual goodwill and regard to respective interests, arrangements may be arrived at not only satisfactory to the governments concerned but also remunerative to the Marconi companies, who have invested so large an amount of capital in the establishment of this present wireless organisation."

Manufacture of Apparatus.—"The company owns a fully-equipped factory adequate to cope with the expanding demand for instruments and installations. Over 500 wireless stations have already been equipped by the company, and the number is constantly being added to. Considerable orders are received each year from the British Admiralty and foreign governments for wireless telegraph apparatus and accessories. The Marconi system is also in use for naval and military purposes in Italy, Russia, Belgium, Chili, Brazil, China and Siam. This branch of our business may be expected to lead to large and profitable demands for our manufactured apparatus. Our factory is freehold, and is valued as a going concern with its equipment and stock at over £95,000."

The following notes appear in the report concerning operations in various countries:—

United States.—With regard to the Marconi Wireless Telegraph Co., of America, the long-distance station at Cape Cod, as is the case at Poldhu, has been supplying a daily news service to ships fitted with long-distance receiving apparatus, and the fore shore stations at Seagate, Sagaponack, Siasconsett and South Wellfleet on the American seaboard have contributed their quota to the wireless exchange. The action in respect of Mr. Marconi's magnetic detector patent has been decided in our favour.

Canada.—The Marconi Wireless Telegraph Co., Ltd., of Canada, has erected the trans-Atlantic station at Glace Bay which corresponds with our station at Clifden, and for communication with ships further stations have been completed at Cape Bear, Prince Edward Island, Quebec, Grosse Isle and North Sydney, and there are now altogether 20 Marconi stations on the Canadian shores and the St. Lawrence River.

Newfoundland.—Contracts have been made with the Government of Newfoundland for wireless stations, and five stations are working on the Labrador Coast. One of these contracts secures to the company exclusive rights for wireless telegraphy in Newfoundland.

South America.—During the period under review a company has been formed at Buenos Ayres, and is now commencing to install wireless telegraph stations with a view to extending the operations of the wireless exchange to South America. It is the intention of the Argentine Co. to erect a long-distance station to communicate with the long-distance station now being erected by the Italian Government under the supervision of Mr. Marconi, at Coltano, in Italy. In other parts of the South American Continent the Marconi system is gradually being adopted.

Belgium.—The Compagnie de Télégraphie sans Fil of Brussels, with which we have been connected for many years and which is earning profits, recently proposed to this company to increase their capital by the admission of other international elements, and to work a further portion of our Continental business. Your board are considering these proposals.

France.—In France the company's interests are represented by the Compagnie Francaise Maritime et Coloniale de Télégraphie sans Fil, which is earning profits and paying a dividend.

Italy.—In Italy there are 22 Marconi stations which are available for communication with ships fitted with our instruments, and 14 vessels of the Italian mercantile marine which have already been installed with Marconi instruments. The long-distance station at Coltano is being erected by the Italian Government under the supervision of Mr. Marconi, for the purpose of trans-oceanic communication with the other long-distance Marconi stations. This company is much indebted to the Italian Government for their far-sighted and cordial support.

Lloyd's.—During the period under review Marconi apparatus has been installed at Lloyd's stations at the Butt of Lewis and the Flannan Islands. The directors' relations with Lloyd's Corporation are of a friendly character.

Admiralty.—The Marconi system is in use throughout the British Navy and at British naval stations in the United Kingdom and abroad. Under the terms of its agreement with the company, the Admiralty continues to utilise the company's high power stations for communication with the ships of the fleet, whether in home waters, in the Atlantic, or in the Mediterranean, within a radius of 2,000 miles.

Six of the Trinity House Lightships, viz., the *Sunk*, *Gull*, *South Goodwin*, *Tongue*, *Cross Sand*, and *East Goodwin*, are now fitted with the Marconi apparatus. This business is capable of considerable development.

Increase of Capital.—The directors have been considering for some time past the adjustment of the capital account, and they ask the shareholders to approve the following resolution:—

That the capital be increased to £750,000, by the creation of 250,000 preference shares of £1 each, conferring the right to a fixed cumulative preferential dividend (in priority to all other shares) at the rate of 7 per cent. per annum on the capital for the time being paid up on such preference shares, and also, subject to the payment of a non-cumulative dividend of 10 per cent. per annum on the ordinary share capital of the company for the time being paid up, the right to participate *pari passu* in proportion to the capital paid up with the ordinary shares in any profits not required for the payment of such preferential dividend, and of a non-cumulative dividend of 10 per cent. per annum on the ordinary shares which it shall from time to time be determined to distribute, and the right in a winding up to rank in priority to all other shares for the repayment of capital and *pari passu* with all other shares in any excess after repayment of capital paid up thereon.

"The proceeds of the new issue will serve to pay off the company's engagements to bankers and others. There would then remain, in the opinion of the directors, an amount sufficient to carry on and extend the business of the company, to complete the long-distance stations, to provide these with the necessary land-line facilities, and to enable the company to deal with the orders already received and likely to be obtained. The shareholding of the company in the subsidiary companies, which should become exceedingly valuable as the long-distance business progresses, should provide further resources for the extension of the company's business."

In March last the directors made an agreement with Mr. H. Cuthbert Hall that he should relinquish the position of managing director and his suggested present and future claims for commission in consideration of a payment in cash and of the allotment to him of 10,000 fully paid-up shares in the company. He has since retired from the board.

Dudley, Stourbridge and District Electric Traction Co., Ltd.

The meeting of this company was held on Thursday last week at Donington House. Mr. A. C. Miles presided, and in moving the adoption of the report (see Electrical Review, April 24th, page 709), he said that in spite of the inclement conditions which prevailed throughout the whole of the summer and the depression caused by bad trade in the district, the report showed that satisfactory progress had been made. Traffic receipts had amounted to £45,693, which was within 11s. of those of the previous year in spite of the falling-off in passengers to the number of nearly 130,000. Advertising and sundry receipts had remained at about the same figure as in the previous year. On the other hand, operating expenses, repairs and maintenance had increased on account of the additional repairs that had been carried out to the rolling stock and the permanent way, which during the past year called for a very great deal of expenditure. The items under administration and general expenses were about the same, excepting the last item under the heading of office, travelling and general expenses, which showed an increase of about £400, and included in that amount was the payment in respect of the use of the Tividale car workshops and also the subscription to the British Electrical Federation, which items appeared in the accounts for the first time. With regard to the Tividale car workshops, there was no doubt that the centralisation of the workshops for the whole system at that place would tend to economy in the carrying-out of repairs. The shareholders would also observe that the directors had adopted the policy of providing for renewals before arriving at the profit, and the sum of £2,000 had been included in the profit and loss account for that purpose, which had reduced the divisible profit to £7,949. With reference to the arbitration with the Dudley Corporation, the directors could only regret the decision arrived at by the House of Lords. They proposed to use the purchase money arising from the sale of the tramways and light railways at Dudley for the purpose of purchasing the Kinver Light Railway. That was a most improving property, the net profit this year showing as much as 33 per cent. more than that earned in the previous year, and in respect of which they were at present under the obligation of paying the sum of £3,000 per annum to the Birmingham and Midland Co., in addition to the cost of the outstanding charges already mentioned. The increase in the profits on that line could be traced almost directly to the fact that under the management of the Joint Committee, cars were now able to be run from all points of that prosperous route through to the holiday resorts. With regard to the agreement proposed to be entered into with the Birmingham and Midland Co. and the Shropshire, Worcester and Staffordshire Electric Power Co. to sell to the power company the generating stations at Hart's Hill, Amblecote and Lye, it was hoped that considerable economies would be effected in the cost of energy by the contemplated arrangement, as the Shropshire Power Co. would be in a position to generate electricity on a much larger scale than the company was at present able to do. They would doubtless benefit by being able to purchase current at a lower figure than they had been able to generate at themselves. The arrangement with the Joint Committee for the management of the tramways had been renewed, as it had been found that the operation of the company's tramways had been attended with satisfactory results, and considerable economy was expected to accrue in the future from the centralisation of repairs at the Tividale workshops. The parcels and goods traffic had shown a profit of £96 for the year. That traffic was only in the early stages of development, and the directors had every confidence that in the course of time the business would develop into a substantial portion of the undertaking.

Mr. S. R. Blundstone seconded the motion, and the report was adopted.

City of Birmingham Tramways Co., Ltd.

Mr. Emile Garcke (Chairman) presided at Donington House, on the 24th ult., over the ordinary general meeting of this company. In moving the adoption of the report (see Electrical Review, April 24th, page 713), he said that nothing had happened during the past year that was not anticipated in a very large degree some years ago. As they were aware, they lost some of the lines at the end of December, 1906, and the result in the loss of traffic during the past year had been £124,000. But the net profits were only £43,359 less than in the preceding year, showing that the expenses of working had been reduced in the same proportion as the receipts. As a matter of fact, the net profit was larger than it would have been proportionately, which was due to their having received rather a high rate of interest on their investments and deposits during the past year. The shrinkage in the receipts had been less than they anticipated would have been the case as the result of losing the lines which reverted to the Corporation, and this was so, notwithstanding the fact that they had been exposed to a very severe competition by the Corporation's new electric tramways, which were competing very seriously with the remaining lines that the company were working. They had been occupied in the past year in continuing negotiations for the realisation of the company's remaining assets, and at the present moment they had accumulated a redemption fund for the repayment of the debentures and the investment fund. Their liquid assets were very nearly approaching the total amount of the paid-up capital and obligations. He should point out, however, that the investments included one in the Birmingham Motor Omnibus Co., which stood at £50,000, and which he was sorry to say was not likely to produce its full value. As a matter of fact, that particular asset was regarded by the directors with some anxiety, for the business of working motor-omnibuses in Birmingham had not been at all satisfactory. Taking it altogether, he thought they would recognise that the financial position of the company was satisfactory, and having regard to the remaining assets which they had, he had no misgiving but that their original estimates would be realised. They had the Bristol Road tramway and the cable tramways until 1911, which represented 4¼ miles, and they had 7½ miles of tramways outside the city, some of which belonged to the company, and were not purchasable by the local authorities until 1936. Then they had also the working of the lease of the Aston Corporation Tramways, which, however, were not yielding at present any profit to the company. On a former occasion he touched upon the question of whether it would be advisable to carry on the operations of the company in future under the powers of a liquidator, but various negotiations which had still to be carried on with local authorities were of such a nature that it was not advisable to put the company into liquidation at present. Moreover, so long as they were able to earn more than 4 per cent. on their investments, there was no direct economic advantage in liquidating the company merely for the purpose of redeeming the debentures upon which they paid 4 per cent.

interest. The average yield of the company's investments during the past year was about 5½ per cent. Of course, last year the rate of interest was rather high, and they could scarcely hope to maintain the same yield with the same security with a falling bank rate, but there was very little doubt that they could do better than the interest which had to be paid upon the debentures. So long as they could ensure this, there was no advantage in putting the company into liquidation except for the small economy that might be effected in the costs of administration. The endeavour of the directors was to keep down the expenses of management to the lowest possible point, and there was no reason why they should not succeed in bringing them to practically the same level at which they would stand in the event of the remaining portion of the company's business being carried on by a liquidator.

Mr. Granville C. Cunningham seconded the motion, which was carried, as was also one for the payment of a dividend of 5 per cent. on the ordinary shares, together with a bonus of 5 per cent., making 10 per cent. for the year.

The Indo-European Telegraph Co., Ltd.

The meeting, held on Tuesday at 18, Old Broad Street, was presided over by Mr. J. Herbert Tritton, who, in proposing the adoption of the report (see the Electrical Review, April 17th, page 671), said that they were aware that the Director-General of Imperial German Telegraphs was *ex officio* a member of the board. Herr Sydow, who, until a few weeks ago, occupied that position, had relinquished it in order to take up the high office of Finance Minister of the German Empire. The directors had great pleasure in referring publicly to the very friendly nature of their relations with Herr Sydow, and to the unfailing courtesy displayed by him towards the company, and while placing on record their great regret at the severance of these friendly relations, they at the same time offered him their heartiest good wishes in his new office. Turning to the report, Mr. Tritton said it would be observed that the directors were able to speak favourably of the satisfactory working of the company's system. There had been a steady progress in the reduction both of the time occupied in transmission of telegrams, and of the number of errors made. To go into figures, taking a telegram to India or the Far East, the average time that elapsed between the receipt of the telegram at the company's transmitting station in London, and the time it was handed over to the company's department in Teheran for further transmission, was in 1906 40·55 minutes, and in 1907 36·8 minutes—a reduction of approximately 5 minutes, and that without addition to the number of wires at their disposal, and in the face of an increase in the number of telegrams transmitted. In 1907 the percentage of errors made by their instrument clerks was ·044—that was under one error per 2,000 words transmitted, as against ·046 for the preceding year. Those improved figures were referred to by the directors with all the more gratification owing to the fact that they had been attained under the strain imposed upon the staff by the pronounceable-combination-code theory of code formation, upon which the very great majority of codes now in use were based. Ever ready to meet the reasonable demands of merchants, the London Telegraph Conference of 1903 admitted as code any words, whether genuine or artificial, formed of syllables capable of pronounciation, according to the usage of one of the German, English, Spanish, French, Dutch, Italian, Portuguese or Latin languages. The practical outcome of this concession had been words made up of two and three-letter permutations and combinations of the letters of the alphabet, limited in scope only by the necessity of interpolating a minimum of vowels to keep up the appearance of pronounceability. Thus they got code words such as those mentioned in the recent letter of the General Post Office to the London Chamber of Commerce, viz, Bujksrocty, Bywrgrocbx, and Liqraqkper, which it was impossible to consider as pronounceable. The transmission of combinations such as those presented enormously increased difficulty to the operators, owing to the fact that they had to be spelt out letter by letter, there being no possible check to avoid error such as there was when code words had a real existence in a real language. To the delay in transmission resulting from those causes, there must be added the further delay resulting from the enormously increased number of repetitions rendered necessary by the use of artificial words referred to. It would hardly be believed, but telegrams of repetition formed, on their system, 25 per cent. of the whole number of telegrams carried. They would, therefore, see that the use of these unpronounceable combinations was not an unmixed blessing to the users. The company was now making experiments with the duplex system applied to the Wheatstone working, and, so far, the results had been satisfactory. The object at present was to make up for the possible temporary loss of one of their two cable wires, in case the relative cable was interrupted, but should a permanent increase in their carrying capacity be rendered necessary by increasing traffics, it might become imperative to make arrangements to introduce duplex working over the whole of their system. The Turkish traffic carried by the company continued to furnish a considerable revenue. There had been a falling off in the Russian traffic, but they saw no reason why there should not be a revival of the business in the near future. The traffic exchanged with India and countries east of India was responsible for most of the increase shown in the message receipts. The revenue from message receipts and other sources, as shown by the income account, amounted to £136,579, as compared with £124,610 in 1906, being an increase of £11,969. Turning to the expenses, they were £73,053 as against £73,643 in 1906, a decrease of £590. He thought they would consider it satisfactory to produce an increased revenue from a decreased expenditure. The depreciation in investments was again heavy, and to meet it, the sum of £18,144 had been provided out of profit. They would see that the investments were of the highest class, and they might look forward to an improvement in the values before long. The directors proposed the usual final dividend of £14,875 and bonus of £17,000, leaving £8,558 to be carried forward, as against £8,974 last year. They had again decided to recommend a distribution from interest on investments, of 15s. per share (free of tax). The sources from which that distribution was made last year not being quite sufficient, a small supplementary sum of £288 had been appropriated from interest on equalisation of dividends fund investments.

Mr. Charles Holland seconded the motion, and the report was adopted.

Sir W. R. Brooke, K.C.I.E., in proposing the re-election of Mr. J. H. Tritton and Mr. L. Delbrück as directors, remarked that Mr. Tritton had now completed 40 years' service as a director of the company, and 20 years as chairman, and it was the intention of his colleagues at the close of the meeting to ask his acceptance of a testimonial in recognition of that fact.

Mr. Straube, in seconding the motion, said that having been connected with the company since its inception, and speaking as an expert in such matters, he thought he might say that its management had been excellent from the telegraph man's point of view, and also from a financial standpoint—a combination which was not always met with. He felt sure that had the shareholders known that there was an intention to make a presentation to Mr. Tritton, they would all have gladly taken a part in it, as he thought they would wish to mark their sense of the way in which the chairman and his colleagues had conducted the affairs of the company. Under the circumstances he would ask the directors to put a clause in the notice convening the next annual meeting that at that meeting it was the intention of a shareholder to move that a substantial sum be voted to the directors in recognition of their past services to the company.

The resolution was carried.

At the conclusion of the business, Mr. Charles Holland formally presented Mr. Tritton with three silver vases after James II models, suitably engraved. In making the presentation, Mr. Holland said he asked Mr. Tritton to accept the souvenir, on behalf of his colleagues on the board, the heads of departments and the foreign representatives of the company, as an expression of the very kindly feelings entertained for their chairman.

Mr. Tritton thanked Mr. Holland in suitable terms for the gift.

Johnson & Phillips, Ltd.

The annual meeting was held on Monday at Winchester House, Mr. R. W. Blackwell presiding.

The Chairman, in proposing the adoption of the report, said he was glad to say that the business of the company had been well sustained during the past year; in fact, the turnover had been the largest during the company's existence. That must be attributed in some considerable part to the largely increased cost of material during the earlier period of the year. After making provision for bad and doubtful debts, and putting out of revenue £4,300 for maintenance of buildings, plant, &c., there was a balance of £31,530. Adding the balance brought forward from the previous year of £11,452, that put at their disposal for appropriation a total of £42,982. It had seemed well to the directors out of that amount to set aside £5,500 for depreciation on plant, buildings, &c.; the remuneration of the directors and auditors absorbed £1,360; the interest on the debenture stock to December 31st last amounted to £8,498, and in view of the general depreciation in all industrial securities, they had thought it well to further write down the investments by £500. The total of those deductions amounted to £15,858, which left a balance of £27,123 available for dividends. Out of that it was proposed to pay a dividend at the rate of 7 per cent. per annum on the 175,000 ordinary shares, which absorbed £12,250; to transfer £8,000 to the reserve account, which left a balance of £6,873 to be carried forward. The business of the company being centred in general telegraph and submarine work, in the making of india-rubber, and in the manufacture of cables of all varieties, they had consequently been sufficiently fortunate in escaping the very great troubles which had been encountered by companies engaged solely in the manufacture of distinctly electrical engineering apparatus. The new works which they established in the early part of last year had been entirely completed, and he was glad to say that they had been entirely occupied during the whole period, and he felt sure that any shareholders who visited the works and saw them in operation would consider that the investment in them had been fully justified. In view of the very considerable costs which they had to pay at the present time for the supply of their motive power they were extremely glad to know that apparently steps were being taken to obtain such Parliamentary powers as would really constitute something in the way of a bulk supply for London. At the present moment they were practically dependent upon a single source for their electrical power, and any breakdown in the individual station would be of the greatest possible disadvantage to them, and to be able to obtain a constant and reliable supply from a central source would be a great advantage to them, as it would be to many other manufacturing interests in London. In concluding, the chairman referred to a circular issued by a City firm offering shares in the company in a way calculated to give the impression that the directors were making a fresh issue of shares, which, of course, he said was not the case.

Sir Henry Benbow, K.C.B., seconded the motion.

Mr. T. Deuce inquired whether the new works had been constructed of fireproof material, and asked whether the cost of the works had been borne out of revenue. He also desired to know what were the company's prospects for the current year, as he had heard it said that the shops were not as busy as they were this time last year.

Mr. Baldwin expressed the hope that the directors would limit the capital account as much as possible, and that they would not enter into contracts where they had to take shares as part payment.

The Chairman, in reply, said that in building the new workshops everything possible had been done to make them fireproof. The cost had been charged to capital, but the expenditure necessitated by moving in, which was pretty considerable, had been paid out of revenue. The company had taken little or nothing in shares in any concern, in payment for contracts. With regard to the current year, their shops were not quite so full as they were this time last year, but they had no reason to suppose that on the whole they would do less business. The reason they were a little behind at present was due to the fact of their having cleared the shops of very large contracts almost immediately before the end of the year. With regard to the payment of an interim dividend, the directors had given that question careful consideration, but they had always decided against it, owing to the expense which would be caused by a half-yearly stock-taking.

The report was then adopted.

British Aluminium Co., Ltd.

Mr. John D. Bonner presided at the annual meeting, held last Friday at Winchester House. In moving the adoption of the report (see Electrical Review, April 24th, page 713), he said that the profit for 1907 of £120,481 was, with the exception of the record profit for 1906, considerably greater than that of any previous year. The result was satisfactory, having regard to the derangement of the metal markets of the world last summer, which followed on the collapse in copper. The immediate consequence of that collapse was a tremendous falling off in the demand for all metals, and this demand continued sluggish, notwithstanding the material recessions in price which had from time to time taken place. Latterly, however, aluminium had been in much better request, and important buyers had assured him during the last few weeks that great developments in the industry might be expected when consumers realised that continuous supplies of the metal could be counted upon at about the present price, or, at all events, at a price not greatly higher than that now ruling. There was an impression existing that prices had been reduced by the principal producers in the hope of killing smaller competitors, and if that end were attained, a sharp advance might be expected. The best answer he could give to that was that they had contracts concluded for deliveries extending to 1910, and contracts for further large quantities were on the point of completion on the basis of that day's current price. The fact was that the aluminium industry had entered upon a new phase, which, when addressing them some 15 months ago, he said would probably be the case when the great extensions, which were then being carried out, to the then existing works, were completed. Clearly they would have in the future to be content with a much smaller percentage of profit than they had hitherto been accustomed to, so that they would have to greatly increase their sales to continue to secure satisfactory results. Up to the end of last year, their only producing works were those at Foyers, but now that their works at Stangfjord and their temporary works at Kinlochleven were in operation, their output should this year be about twice what it was last year, and by about the middle of next year their great works at Kinlochleven should at last reach the producing stage. At Leven the various sections of the works were advancing rapidly, and they should certainly be finished within the extended time of one year, which Parliament was allowing for carrying them out. The development of the Orsières power scheme was proceeding very satisfactorily, but they did not expect to have any power available there until the end of next year. Those works had necessitated further additional capital, and they had accordingly issued 20,000 more "A" preference shares and 40,000 1908 conversion shares. These latter would become fully paid and be divided into preference and ordinary shares at the end of the year, and the capital account would then be materially simplified and would consist of three classes of shares—namely, £300,000 "A" preference shares, £500,000 7 per cent. preference shares, and £500,000 ordinary shares, the two last-named participating equally in any profits remaining after 7 per cent. had been paid upon the ordinary shares.

The motion having been seconded, a Shareholder asked whether the board were keeping fully in mind the necessity of keeping ample working capital in reserve. Another shareholder asked whether the board were taking steps to enforce the penalty upon the contractors for the extraordinary delay in the completion of the Kinlochleven works. A third asked what was the current price at which contracts had been booked for a considerable period ahead, and whether it showed a clear profit.

The Chairman, in reply, said that at the meeting held early last year he explained that in addition to the capital which was then created for developing these power schemes and placing at their command a large amount of power which would ultimately be such a valuable asset, they would also have to exercise their borrowing powers, which meant that they would have in some way to consolidate and extend the debenture debt. That was a matter which would receive attention a little later on. With regard to the works at Kinlochleven, it was quite true that under the contract they had with the principal contractor—altogether there are five contractors with very large contracts and they had contracts with sub-contractors—he was liable for penalties, and, therefore, it was not desirable that he should indicate in the slightest manner what action they were going to take with regard to that contractor, but their interests would be duly safeguarded. As to the current price, it was between £80 and £90 per ton according to the quantity which the buyer required, and as they would have very largely increased quantities to sell from the output of their new works, he thought they were quite safe in effecting the sales which they were then doing.

The report was adopted, and the necessary resolutions declaring dividend, re-electing directors and auditors, &c., were passed.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Tuesday, April 28th.—Langkat Sumatra Rubber Co., Ltd.—31,000 shares of £1 each, 14s. paid, Nos. 31,501 to 62,500.

Sumatra Para Rubber Plantations, Ltd.—20,000 vendors' shares of £1 each, fully paid, Nos. 50,001 to 70,000.

And ordered the last-named securities to be quoted in the Official List.

Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Montreal Light, Heat and Power Co.—Scrip, fully paid, for $400,000 4½ per cent. first mortgage bonds.

South Metropolitan Electric Light and Power Co., Ltd.—Further issue of 25,000 7 per cent. cumulative preference shares of £1 each, fully paid; and £20,000 4½ per cent. first mortgage debenture stock.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The report to December 31st, 1907, states that the power sold constitutes a record. The increase in the profit earned, though not proportionate to the power sold, owing to the reductions made in price, is satisfactory. For the 12 months the profit is £26,597. After writing off £850 for reconstruction and registration expenses, and £3,736 the cost of issuing debentures to replace those which matured in February, 1907, the balance is £22,010. Debenture interest account required £2,091; dividends on preference shares, £6,750; dividend tax in Western Australia, £337; there is placed to reserve for depreciation and renewals, £7,500, and carried forward £5,330. Since the date to which the accounts have been made up a dividend has been declared at the rate of 6 per cent. per annum for the six months to March 31st on the preference shares, and the directors recommend that a dividend be paid at the rate of 5 per cent. per annum for the six months to June 30th next on the ordinary shares. The new plant installed towards the end of 1906 continues to give satisfaction, being more reliable and economical than the original installation. It has been decided to add a 1,000-kw. up-to-date set, which, it is hoped, will still further reduce the cost of maintenance and upkeep, and give a still more reliable and satisfactory plant.

Craigpark Electric Cable Co., Ltd.—The directors' statement for the year ended March 31st, 1908, shows a net profit of £7,128, plus £604 brought forward, £7,732. The directors recommend that there be depreciation written off buildings and machinery, £1,000. The dividend of 6 per cent. on the preference shares absorbs £2,250, and one of 6 per cent. per annum on the ordinary shares requires a further £2,250. There is placed to reserve account £1,000; and there is a balance carried forward (subject to payment of directors' fees for the past year) of £1,232. The cable department shows a satisfactory increase, notwithstanding the general depression in trade. The prices of raw materials are more favourable, and the directors look forward with confidence to the business of another year. The golf ball department continues to be fully employed, and increased sales are anticipated. The company has become a member of the Cable-Makers' Association, and the directors are of opinion that this will prove beneficial to the company.

Electric Traction Co. of Hong Kong, Ltd.—The report for 1907 states that, after paying debenture interest and all other charges, there is a profit of £5,950, which, added to the amount brought forward, makes a total of £6,530. Out of this there has been placed to the reserve for depreciation and renewals £6,000, raising that fund to £12,000, and £530 carried forward. Steady progress has again been made. The receipts were £42,705, as against £41,063, an increase of 4 per cent. Owing, however, to the very large loss sustained in respect of subsidiary coinage amounting to £4,400, representing over 16 per cent. of the total working expenses, the profit has again been adversely affected. A Committee were appointed by the Governor to inquire into the subsidiary coinage question, but they are divided in their opinions as to the best solution of the difficulty. Unless some definite step is taken at an early date to mitigate the evil, the board will have to consider the question of raising the fares charged.

The meeting was held in London on Wednesday.

West Coast of America Telegraph Co., Ltd.—The report for 1907 states that the gross receipts amounted to £61 854, against £68,048 in 1906. The working expenses were £34,616, as compared with £34,173. After providing £6,000 for the interest on debentures and income bonds, income-tax, and including £1,922 brought forward, there is a balance of £22,167. Of this £16,000 has been placed to the general reserve fund, and £2,000 to the maintenance ship's reserve fund. The directors recommend a dividend of 2½ per cent., free of income-tax, leaving £1,354 to be carried forward. The directors report the death of Mr. F. Walters, and Mr. F. A. Johnston has been appointed to the vacancy.

MARKET QUOTATIONS.

Wednesday, April 29th.

CHEMICALS, &c.		atest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	38/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£24	..
a Lead, Nitrate	per ton	£28	..
a ,, White Sugar..	per ton	£27	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	9½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	100/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£106 5	..
b ,, Wire, in ton lots ..	per ton	£140	..
b ,, Sheet, in ton lots ..	per ton	£138	..
v Babbitt's metal ingots	per ton	£50 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	6½d.	1d. dec.
c ,, Tube (brazed)	per lb.	8¾d.	¼d. dec.
c ,, ,, (solid drawn).. ..	per lb.	7¾d.	¼d. dec.
c ,, Wire, basis	per lb.	6¾d.	¼d. inc.
c Copper Tubes (brazed)	per lb.	9¾d.	..
c ,, ,, (solid drawn) ..	per lb.	9¾d.	..
g Copper Bars (best selected) ..	per ton	£75	dec.
g Copper Sheet	per ton	£75	dec.
g ,, Rod	per ton	£75	dec.
c ,, (Electrolytic) Bars ..	per ton	£60	..
c ,, ,, Sheets ..	per ton	£77	..
c ,, ,, Rod ..	per ton	£65	..
c ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb	8/-	..
n German Silver Wire	per lb.	1/7	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	3/6	8½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/11	..
l ,, Wire, galv. No. 8, P.O. qual.	per ton	£14 5	10/- dec.
g Lead, English Ingot	per ton	£13 2 6 to £13 7 6	17,6 dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/2	..
p ,, rolled bars & rods	per lb.	1/2 to 1/3	..
p ,, ,, strip & sheet	per lb.	1/2½ to 1/5	..
o Platinum	per oz.	100/-	..
e Silicium Bronze Wire	per lb.	..	..
Steel, Magnet, in bars	per ton	£60	..
g Tin, Block (English)	per ton	£144 to £145	£2 10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/11	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£34 to £58	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£25 10	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Prospectuses. — *Kaministiquia Power Co., Ltd., of Montreal.*—$1,325,000 of first mortgage 30-year 5 per cent. gold bonds in this company have been offered in London this week at 97 per cent. The company was incorporated in 1905 to exercise certain water power rights (the Kakabeka Falls on the Kaministiquia River, Ontario Province). The power station is 18 miles from Fort William and Port Arthur. Figures were given in the prospectus concerning operating expenses and income from power contracts for the three months ended January 31st, 1908.

Compagnie Générale de Tramways de Buenos Ayres.—An issue of 100,000 shares of 100 francs (at 115 francs each), and of 39,846 4 per cent. debentures of 500 francs each (at 460 francs each), is being offered in Brussels. The list closes on May 5th.

Meldrum Bros, Ltd.—According to the *Financier*, the accounts just issued show a loss of £6,655, plus £7,884 brought forward, making a total debit balance of £14,539 to be carried forward.

STOCKS AND SHARES.

Tuesday Evening.

Without having any fresh business to support markets, the Stock Exchange has been worried and depressed by the multitude of fresh issues, which continue to pour out in a stream that seems to have no end to it. Flatness in Consols remains a disturbing feature, and puts a check upon whatever inclination there might have otherwise been for investment securities to rally. The only section displaying any real force of activity is that for the mercurial American Railroad shares.

Out of the lists of prices on the ensuing pages, the outstanding feature is a yet further rise of 4 points in American Telephone and Telegraph capital stock. There is little stock in the market on this side, and persistent demand for it, in comparatively small sums, has sent the price up to 123 middle. The 4 per cent. bonds remain about 86, at which the yield on the money is 4⅝ per cent.

National Telephone issues are good, and rises of 10s. have occurred in the First and Second Preference shares and in the Deferred stock. Chili Telephones, Monte Videos and Orientals keep steady.

Home Railway stocks continue to take their cue from the still downward movement in Hope Deferred. The Easter traffics turned out badly, after all, and the variegated weather of the present charming Spring does not appear to be benefiting even the Tube Railways. Central Londons, however, are buoyed up a little on the immediate prospect of the Exhibition traffics, which begin next month, and the 4 per cent. Preferred stock has gained a point. On the other hand, Metropolitan Consolidated declined, and Districts lost their rise of last week. Great Northern and Piccadilly 4 per cent. Debenture changed hands at 87½ on Monday.

Amongst the new issues of interest to the electrical world are those of the Marconi Company and the Electrobus. Neither carries much fascination, on the surface of things. The Marconi Company's promise and performance of great commercial success have still to meet, and however great may be the admiration extended to the inventor and his system, as a matter of plain business, it must be admitted that the company offers very slender attraction to the investor. Some sort of a balance-sheet, one would have thought, should accompany the appeal for more money by such an undertaking.

Criticism on the technical side of the Electrobus proposition would be out of place (even were it possible) in this column, but from the financial standpoint the estimates of profits certainly do not seem to err on the side of caution. In fact, the investor who has had any experience of other motor-bus companies might roundly condemn those estimates as far too sanguine. The device of offering the right to subscribe one Deferred share for every 20 of the other shares applied for, is surely a little childish.

Other traction shares are somewhat dull. Metropolitan Electric Tramways Preference have fallen a little, Anglo-Argentine Second Preferences are down ½, and British Electric Second Debenture shed a point. On the other hand, Anglo-Argentine Debenture continues to mount, and British Columbia Preferred is slightly better, which is also the case with British Thomson-Houston 4½ per cent. Debentures.

The British Westinghouse report and balance-sheet for the year ended December 31st, 1907, show a trading profit of £92,383, from which deductions are made for interest and sundry depreciations, leaving £11,341 to be carried forward. The directors confess that "at the present moment demand is slack," but add that the company's improved commercial position will enable it to take advantage of any revival in trade. The annual general meeting will be held next Monday, May 4th.

Mexican Light and Power Capital stock has fallen several points to 47½, while the bonds are 1 per cent. lower at 84. Canadian General fell 3, and this section is not a good market at the moment.

Charing Cross, City Undertaking Preference have weakened in the lighting list. City of London Ordinary are easier, though the Preference improved. Chelsea shares have given way slightly. There has been some amount of demand for the Folkestone issues, though Newcastle-on-Tyne have declined. A further fall in Edmundson's Debenture stock has left the price 5 down.

Telegraph stocks are steady to good. The Eastern descriptions have several advances to show, small in extent, but useful as indicating the investor's appreciation of the merits of the stocks. Anglo-American Telegraph Deferred and West Coast of America shares have eased off. The Trust Companies' securities are unchanged. Manufacturing shares tend to slide away. National Electric Constructions at 8s. 9d., are a little lower.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations April 21st.	Closing Quotations April 28th.	Business done week ended April 28th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent £ s. d
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2 — 3	2 — 3	..	..	..	Nil
143,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 14 11
$131,551,400	American Telephone & Telegraph, Cap. Stock	$100	7¼%	7½%	8 %	8 %	117 —121	120 —124	130	..	+3	6 9 1
£3,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	..	85 — 87	85 — 87	86	..	..	4 12 0
622,600	Anglo-American Telegraph	Stock	2⅜%	3½%	3⅞%	3½%	55 — 58 xd	55 — 58	..	..	..	6 0 8
8,188,700	Do. do. 6 % Pref.	Stock	5⅜%	6 %	6 %	6 %	98½—100½	99 —101	100	99½	+ ½	5 18 10
8,188,700	Do. do. do. Deferred	Stock	Nil	½%	1⅜%	1 %	13— 14	13½— 14	13⅞	13⅜	— ¼	7 5 6
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	98½—101½	98½—101½	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 — 7½	7 — 7¼	..	..	..	5 6 8
2,300,459	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 87	84 — 87	86	84	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	5 %	..	7⅞— 8½	7⅞— 8⅛	8	7⅞	..	6 5 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	16 — 17	16 — 17	..	..	..	5 17 8
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3½— 3¾	3½— 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	8½— 9½	8½— 9½	..	..	..	5 5 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	99½—102½	99½—102½	..	..	..	4 15 8
60,710£	Direct United States Cable	20	3½%	4½%	4⅝%	..	13½— 14	13½— 14	13⅞	13½	..	6 12 2
53,700£	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	..	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	130 —135	131 —136	133½	132½	+1	5 2 11
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	84 — 87	84 — 87	86	85	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	..	101 —104	101½—104½	103½	102½	+ ½	3 16 7
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	12⅝— 13⅜	13 — 13½	13½	13⅛	..	5 4 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99 —102	99½—102½	..	..	+ ½	3 18 1
286,800	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..	15 13 8
181,127	Globe Telegraph and Trust	10	5⅜%	5½%	5½%	..	9⅞— 10⅜	9⅞— 10⅜	10⅛	9⅞	..	5 6 0
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13⅜— 14½	13⅜— 14½	14	13⅜	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	20 %	31½— 33½	30 — 32	..	..	—1½	6 5 0
24,300£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99½—101½	..	..	+ ½	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	55 — 58	55 — 58	..	..	..	6 9
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	..	58 — 63	58 — 63	..	..	..	5 11 1
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	62 — 66	62 — 66	..	..	..	6 1 3
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	9/-	9/6	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	19/9	..	..	4 14 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅞— 1	⅞— 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 — 109	107 —109	108½	107½	..	5 10 1
8,341,425	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	108 —110	108½—110½	109½	108½	+ ½	5 8 7
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10½— 12½	11⅜	10⅞	+ ⅛	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10 — 12	10½— 12½	10⅞	..	+ ⅛	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5⅝	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,710,698	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101½—103½	101½—103½	103½	102	..	3 17 4
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¾%	7 %	7 %	8 %	1⅜— 1½	1⅜— 1½	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	4 %	90 — 93	90 — 93	..	..	..	4 6 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	..	98 —101	98 —101	..	..	..	3 19 3
11,839£	Reuter's	8	5 %	5 %	5 %	..	7½— 8½	7½— 8½	..	..	..	4 19 3
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	126 —129 xd	126 —129	..	..	..	4 13 0
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 — 6½	6 — 6½	6⅛	..	..	6 3 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	4⅜— 5⅛	4⅜— 5⅛	5⅛	..	..	4 15 3
15,609£	West African Telegraph, Shares	10	4½%	4 %	4 %	..	10 — 10½	10 — 10½	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	2½%	..	1⅜— 1⅝	1⅜— 1⅝	34/9	30/7½	— ⅛	2 17 1
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	98 —101	98½—101½	99	..	+ ½	3 18 10
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	13½— 13⅝	13½— 13⅝	14⅛	13⅜	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ¾	⅜— ½	11/6	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	..	8½— 8¾	8½— 8½	..	..	..	9 2 10
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	8½— 9	8½— 9	..	..	..	Nil
80,000£	D do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	101 —104	101 —104	100⅞	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	8 %	..	8 — 8½	7⅞— 8⅛	8 1/16	7 15/16	— ⅛	4 18 6
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	..	6½— 6⅝	6½— 6⅝	6 1/16	6 1/16	..	1 6 3
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	..	130 —135	132 —137	..	..	+2	4 7 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	..	104 —107	104 —107	..	..	..	4 13 6
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	32— 34	32— 32½	75/7½	..	..	5 0 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	3 16 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	3⅜— 4⅛	3⅜— 4⅛	..	..	..	8 9 8
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	4⅛— 4⅜	4⅛— 4⅜	94/6	87/6	..	7 3 7
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4⅛— 5⅛	4⅛— 5⅛	..	..	..	5 11 1
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾— 4⅛	3¾— 4⅛	..	..	..	4 14 1
238,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	101 —104	102 —105	105	102	+1	4 15 3
800,000	Do. do. 5½ % Loch Leven Debs.	100	..	..	5½%	5½%	97 —100	97 —100	98	..	..	5 10 0
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	132 —135	132 —135	133½	..	..	5 18 6
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	110 —114	111 —115	113½	112	+1	4 6 11
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —110	106 —110	109½	..	..	4 10 11
235,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 2
133,301	British Electric Traction	10	6 %	3 %	Nil	..	1½— 1⅝	1½— 1⅝	31/3	30/-	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	4 — 4½	4 — 4½	84/3	..	..	13 6 8
1,448,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	90 — 95	90 — 95	93½	90	..	5 5 3
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	72 — 76	71— 75	..	..	—1	6 0 0
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	..	6½— 6⅝	6⅝— 6⅝	..	..	..	7 10 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝— 6⅛	5⅝— 6⅛	..	..	..	4 18 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	94 — 99	95 —100	..	..	+1	4 10 0
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	..	45 — 50	45 — 50	..	..	..	8 0 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16— 1/4	3/16— 1/4	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	2½%	Nil	..	0— ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..	Nil
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	74 — 79	74 — 79	..	..	..	5 13 11
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	59 — 64	59 — 64	..	..	..	7 0 8
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	4 %	3 %	3 %	..	4⅛— 4⅜	4⅛— 4⅜	..	..	..	3 1 6
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 17 1
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 17 1
810,000	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	110 —116	110 —116	..	..	..	4 6 2
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	6 %	6 — 7	6 — 7	..	..	..	4 8 11
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 13 0
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	102 —106	102 —106	..	..	..	4 4 11
35,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	..	10½— 11½	10½— 11½	..	..	..	5 9 1
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 5 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	106½—108½	106½—108½	..	..	..	4 2 11
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	1/16— 1/8	1/16— 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	..	1 1/16— 1 1/8	1 1/16— 1 1/8	27/9	..	..	5-11 4
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	101 —101	102½	102	+1	4 6 7
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	75 — 78	75 — 78	76½	75	..	3 16 11
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	84 — 86	85½	84½	+1	4 13 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	54 — 57	54 — 57	..	..	..	3 10 2
1,480,000	City and South London Railway	Stock	2¼%	1½%	2¼%	3¼%	39 — 41	39 — 41	39⅜	..	..	5 3 8

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations April 21st.	Closing Quotations April 28th.	Business done week ended April 28th, 1908.		Rise + or Fall —	Present Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	£	2½%	2½%	5 %	..	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	7 16 10
100,000§	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	92 — 95	92 — 95	..	..	..	5 5 8
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	..	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	7 5 5
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..	..	4 16 0
282,580	Do. dc. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100—103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6½%	12½— 13½	12½— 13½	..	..	..	4 18 2
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½— 13½	12½— 13½	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	..	½ — 1	½ — 1	..	..	..	12 10 0
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	..	1½ — 2½	1½ — 2½	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	78 — 81	78 — 81	..	..	..	4 18 9
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	Nil	..	1¼ — 1½	1¼ — 1½	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7½ — 8¼	7½ — 8¼	7⅞	7⅝	..	6 1 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	87 — 90	87 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4%	⅜ — 1½	⅜ — 1½	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103	102 —103	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10½— 11½	10½— 11½	10⅝	..	..	8 18 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅞ — 5⅜	4⅞ — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	5 %	10%	10 %	..	15½— 16½	15½— 16½	16⅜	15¾	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	1%	1⅜ — 1½	1⅜ — 1½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5⅜ — 6	5 — 5½	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	..	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
899,930	Do. do. 50,008 to 100,000	10	6 %	8 %	8 %	..	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	..	6¼ — 7⅛	6⅛ — 7⅛	..	..	..	6 18 4
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	..	80 — 85	80 — 85	80	..	..	4 14 2
5,782,062	Metropolitan Consolidated	100	3 %	2⅜%	1 %	1%	43 — 44	41½ — 42½	43⅜	42½	—1½	1 3 6
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	66 — 68	66 — 68	67½	66½	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	12 — 13	11½ — 12½	12	11¾	..	Nil
814,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ⅜	⅛ — ⅜	15/-	13/9	— 1/8	6 8 1
850,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	95	94½	..	4 12 9
245,500	Potteries E. Trc.	1	5 %	4 %	4 %	..	⅛ — ⅜	⅛ — ⅜	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ⅜	⅛ — ⅜	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	30½ — 32½	30½ — 32½	32	31	..	6 9 8
150,000§	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	8 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	39 — 43	36 — 40	39	38	—3	12 10 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	1 — 1½	1 — 1½	20/-	..	..	6 13 4
66,666	Do. 6 % C.P., 30,001 to 80,000 & 126,001 to 141,666	5	Nil	Nil	..	6 %	3⅜ — 3¾	3⅜ — 3¾	70/6	..	..	7 10 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P,. 1 to 15,000	5	5⅓%	5⅓%	5⅓%	..	4¼— 5	4¼— 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
30,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10 %	7¼— 8¼	7¼— 8¼	..	..	..	6 1 3
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6¾— 7¼	6¾— 7¼	..	..	..	4 10 4
836,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3⅝ — 4¼	3⅝ — 4¼	..	..	..	6 1 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼ — 4⅝	4¼ — 4⅝	90/-	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	4 — 4¼	3⅞ — 4¼	..	..	— ¼	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,426	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	..	3½ — 3⅝	3 — 3¼	67/6	..	— ⅛	6 8 7
175,000§	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	..	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9⅞ — 10¼	9¼ — 10¼	9⅞	..	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅜	12 — 13	..	..	+ ½	4 12 4
400,000§	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	123 —126	123¾	123½	..	3 19 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
40,000	County of Durham Electrical Power, Ord.	£3	7 0	4 %	4 %	..	3 — 3⅜	3 — 3⅜	..	..	..	5 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 5 3
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 6
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11¼	10⅜ — 11¼	..	..	..	5 6 8
400,000§	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	..	1 — 1½	1 — 1½	..	..	..	12 0 1
433,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	57 — 62	52 — 57	56½	52½	—5	7 17 10
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5	4⅜ — 5½	..	..	+ ½	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	4⅝ — 5⅜	5 — 5⅜	..	..	+ ⅛	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6¾ — 6¾	6¾ — 6¾	..	..	..	6 13 4
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	..	7¾ — 8¼	7¾ — 8¼	8	..	..	5 14 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	1 — 1½	1 — 1½	..	..	..	5 0 0
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4½ — 5	4¼ — 5	..	..	..	6 0 0
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	4½%	90 — 93	90 — 93	92½	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4⅜ — 5⅛	4⅜ — 5⅛	95/-	..	..	6 3 11
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	3 18 3
220,000§	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —111	107 —111	108¾	..	..	4 1 1
250,000§	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	96 — 99	96 — 99	..	..	..	4 5 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	..	5⅝ — 6⅛	5⅝ — 6⅛	5⅞	..	— ⅛	6 10 7
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11¼ — 12¼	11¼ — 12¼	11⅜	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	5⅝ — 6⅜	5⅝ — 6⅜	..	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	93 — 95	94 — 98	94	..	+1	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7¼ — 8¼	7¼ — 8¼	..	..	..	6 3 1
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6¾ — 7	6¾ — 7	..	..	..	5 0 0
150,000§	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	⅜ — 1½	⅜ — 1½	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	6 19 2
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2⅜%	2⅜%	2⅜%	⅜ — ⅝	⅜ — ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 1 10
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	11 15 4
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	11 1 10
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	87 — 90	87 — 90	..	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	14 %	13 %	12 %	10 %	7¼ — 8	7¼ — 8	7⅛	7¼	..	6 5 0
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	4¼ — 5¼	4¼ — 5¼	..	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 3 per cent., March 19th, 1908.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1908.

Below we give the tabulated returns of electrical business for the month of March, from which it will be seen that the exports of British-made goods still maintain their satisfactory standing, their value, in fact, being somewhat in excess of anything previously recorded by us. The imports into this country and the re-export section are both up to the average.

The actual figures are:—Exports £208,385, which compares with £183,471 in the previous month; imports £165,556, as against £197,679 in February; and re-exports £15,773, as compared with £15,991 in February.

As regards the export and import values, the figures are well above the monthly averages of 1907, these latter being 167·7 and 154 thousands respectively. The re-export section showed abnormal activity during the latter half of 1907, and the March total of £15,773 represents a satisfactory value.

The heavy total of the exports is evidently largely due to shipments of electrical machinery and cables, which are always a strong feature of this section; prominent purchasers were India, the Argentine, Japan, Natal, and our Australasian dependencies.

A special feature of the imports is the £20,000 worth of lamps imported, of which Germany shipped one-half; machinery, cables, telephonic material and carbons also figure largely. Germany and Holland were the most prominent importers.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.*

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material, and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	20	2,313	13	61	179	3,492	...	...	289	20	...	6,387
Germany	385	1,466	51	55	22	286	17	6	192	...	...	2,480
Netherlands	327	752	23	...	33	1,090	247	...	10	...	...	2,482
Belgium	58	961	11	6	293	1,173	...	...	1,268	...	...	3,770
France	204	5	85	572	23	594	...	16	...	...	...	1,499
Portugal, Madeira and Portuguese Africa ...	343	76	106	266	281	1,807	965	12	95	...	...	3,951
Spain	324	19	23	71	6	3,417	...	...	...	...	...	3,860
Italy and Austria-Hungary	58	...	...	207	1,957	1,151	...	...	...	...	...	3,373
Greece, Bulgaria, Roumania and Turkey ...	74	...	...	21	...	100	...	...	...	29	...	224
Channel Isles, Gibraltar and Malta	183	16	...	11	21	2,949	...	...	...	...	...	3,180
U.S.A., Philippines and Cuba	...	...	...	52	322	144	...	...	...	...	...	518
Canada	157	358	23	79	41	3,751	...	18	...	...	...	4,427
British West Indies and British Guiana ...	76	...	8	9	8	...	...	...	...	...	...	101
Mexico	37	94	...	25	...	847	...	...	...	...	...	1,003
Peru and Uruguay	...	...	27	...	...	113	14	...	28	...	...	182
Chile	197	363	107	55	18	2,797	...	6	63	...	...	3,606
Brazil	1,912	1,148	2,327	239	12	3,845	112	7	135	...	...	9,737
Argentine	1,695	1,697	91	445	442	15,001	1,565	29	401	...	...	21,366
Egypt	69	479	90	11	10	10,103	65	...	67	...	...	10,894
British West Africa	...	3	72	9	22	191	4	7	47	...	...	355
Cape of Good Hope	331	4,924	139	448	...	840	593	134	18	...	...	7,427
Natal	483	7,533	236	211	25	4,514	74	19	...	...	...	13,095
Zanzibar, Brit. East Africa, Mauritius & Aden	...	...	124	3	...	...	...	...	7	...	...	134
China and Siam	1,263	2,938	355	302	134	2,645	...	68	14	15	...	7,734
Japan	812	3,734	57	17	187	13,327	2,024	...	90	...	...	20,248
Java and Dutch Borneo	...	15	...	...	...	794	5	...	...	...	...	814
India...	873	11,786	1,414	1,170	703	9,646	516	487	347	2,769	...	29,711
Burmah	66	3,612	159	54	...	1,688	10	86	53	15	...	5,743
Ceylon	43	462	114	60	...	17	226	2	68	116	...	1,108
Straits Settlements, Fed. Malay States, Brit. North Borneo, Sarawak and Labuan ...	111	448	83	565	97	590	31	52	123	...	...	2,100
Hong Kong	1,488	506	86	15	...	4,190	...	8	10	...	...	6,303
West Australia	79	359	...	51	123	466	...	4	...	...	...	1,082
South Australia	170	...	106	20	19	461	20	...	970	...	...	1,766
Victoria	1,334	5,404	43	737	519	1,491	...	...	...	...	...	9,528
New South Wales	1,450	1,397	245	235	1,395	2,260	64	...	158	...	...	7,204
Queensland	360	39	70	...	...	142	39	...	5	...	...	655
Tasmania	...	...	...	33	...	1,811	...	...	...	...	...	1,844
New Zealand	265	5,255	895	165	...	1,780	25	...	20	89	...	8,494
Total, £	15,247	58,162	7,183	6,280	6,892	99,513	6,616	961	4,478	3,053	...	208,385

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	10	204	10	70	...	1,514	474	12	6,435	...	...	8,729
Germany	3,507	8,894	...	10,394	563	31,533	983	655	1,629	1,710	...	59,868
Holland	687	3,721	265	7,047	2,405	3,770	467	12,323	1,052	81	...	31,818
Belgium	1,109	8,595	98	1,166	20	5,236	182	1,520	8,354	400	...	26,680
France	80	2,340	777	1,505	627	1,519	3,021	2,929	1,344	...	...	14,142
United States	4,321	32	774	321	...	13,176	112	292	116	4,971	...	24,115
Total, £	9,714	23,786	1,924	20,503	3,615	56,748	5,239	17,731	18,930	7,162	...	165,352

Additional Imports: Italy, cable, £197; electrical machinery, £3. New South Wales, electrical machinery, £4.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	3,293	1,969	116	564	103	3,434	91	441	1,054	4,708	...	...

Total Exports: £208,385 Total Re-Exports: £15,773 Total Imports: £165,556

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

* This section does not include telegraph cables and apparatus.

SOME NOTES ON HIGH-TENSION INSULATORS FOR OVERHEAD TRANSMISSION LINES.

By C. J. GREENE.

(*Concluded from page* 718.)

Arcing Distances, Wet.—To attempt to settle on the arcing distance of an insulator working under the worst possible conditions of weather would need a series of experiments carried out during the year in the open, together with the keeping of most detailed and elaborate records, and it does not appear possible in this country to undertake such work, and if we are unwilling to rely entirely on such information as reaches us from abroad, we can only form theories based on such results as it is possible to obtain ourselves.

In considering this question, we must refer again to the two drawings mentioned earlier, and since some starting point must be settled on, we have assumed our insulators to be working under such conditions that rain is being driven against it at an angle of 45° from the vertical. The rain is represented by an arrow, and the wetted surface by the thick black line.

From the fact that we are considering rain as descending at an angle of 45 degrees from the vertical, it must not be assumed that this should form a safe basis for design, as it is probable that under very bad conditions a considerably greater part of the insulator gets wet than would be the case under rain at 45 degrees, and we are simply taking 45 degrees as a convenient basis from which to draw certain conclusions.

The first question which arises is as to how a wet surface of porcelain in contact with a high-tension conductor should be considered, and from the tests carried out there seems but little doubt that the wet surface of the upper shed can be considered as practically a conductor. This opinion is confirmed by American and other authorities, and it seems therefore that we can assume the whole of the surface of the upper shed to be alive at approximately the potential of the line. As to whether the full line potential is obtained at the point B, the extreme edge of the upper shed, is perhaps open to doubt, but it would appear that to all practical intents and purposes this should be so. Our arcing distance is therefore at once reduced by the distance A B in the case of the straight line insulator.

Following the arrow representing the direction of the rain, we next arrive at another wet surface E C, which is situated about halfway between the live shed B and the earthed pin D, and assuming, again, that this wet surface is a conductor, we have the case of a conductor (consisting of the wet porcelain surface) supported on an insulator (the dry part of the porcelain) placed between two points of greatly different potential, and it seems reasonable to suppose that the arcing distance is now further reduced by approximately the distance E C.

On this assumption the arcing distance of the straight line insulator when wet, now becomes B E + C D, no allowance being made for surfaces becoming wet through splashing. It would, however, rather appear from the tests carried out with wetted insulators that the arc is more likely to strike at some point about mid-way between E and C, which would give a rather greater arcing distance. If, however, we set off against this the fact that, owing to splashing and rain drops collecting at the edge of the sheds, the arcing distance is really somewhat less than C D + the length of a line falling midway between B C and B E, we may take it that the assumption that B E + C D is the arcing distance, with rain at 45°, is about correct.

Reasoning in a similar way, the arcing distance of the shackle insulator when wet now becomes B E or B C, and a good shackle insulator should be so designed that the distance B E is equal to the distance B C.

The arcing distances for insulators working under rain falling at an angle of 45° thus obtained, are the distances given for the insulator shown on the curve of arcing distances and the distances given in the following tables, Nos. II, III and IV.

The positions thus marked on the curve are circles Nos. 3 and 4, and it will be noted that these fall somewhat above the curve, this being accounted for by the fact that in the test carried out the insulators were wet all over, and not merely up to the point E.

In these remarks no attempt has been made to include deductions from snow, sleet or fog, as no facilities were available for representing any such effects in our tests.

Standard Makes of Insulators.

Having discussed at some length the question of the voltages at which insulators will puncture or arc over, it is now interesting to examine the sizes and shapes of standard insulators in the light of the deductions mentioned above.

In Tables II and III will be found set forth in detail the chief characteristics of both straight line and shackle insulators as standardised by the leading manufacturers both at home and abroad, and in Table IV will be found abstracted their factors of safety on their designed working voltage. These tables have been prepared with the greatest care; the writer is naturally unable to guarantee that all the information in them is correct, although every possible precaution has been taken.

The tables are very largely self-explanatory, but the following remarks should be noted in conjunction with them:—

Prices.—The prices given are not, of course, absolutely correct, as owing to the quantity ordered, trade discounts, &c., they are liable to vary from time to time. The prices, however, are on the whole fairly accurate, and they are given for the insulator alone, the pin not being included. At low voltages it is interesting to note that the prices of all manufacturers agree very closely. This is no doubt due to the fact that for these small pieces of porcelain the manufacture has been so completely standardised that it is the same with all makers, and no variation in price is possible. At high voltages the prices vary greatly, this being probably due to special difficulties in manufacture, which cost one maker more to overcome than another.

Arcing Distances.—These have been measured both in the case of dry and wet insulators in the manner mentioned above, and no allowance has been made for additional surface becoming wet by splashing, or for the arcing distance being reduced by accumulation of rain-drops on edges of sheds, or creepage of moisture along the underside of the sheds. In every case the distance is measured from the centre line of the transmission wire to the circumference of the insulator pin, the diameter of the pin being assumed as one suitable for the size and height of the insulator.

Designed Working Voltage.—This is the voltage specified by the makers as suitable for their standard insulators, and in every case it has been assumed as the R.M.S. of the actual voltage between line and pin.

Factor of Safety.—This has been taken as the ratio of the actual arcing distance of the insulator, measured as above, to the distance which the specified working voltage would break down, as measured by the series of tests carried out between rods as described at the commencement of the article.

Creeping Surface.—For the insulator in a dry condition this is the actual distance between the centre line of the transmission wire resting in the side groove of the insulator and the top collar of the insulator spindle, as measured along the surface of the various sheds.

Under rain we have a creeping surface partly wet and partly dry, the wet creeping surface being from the side groove to the point B, and from E to C in the case of the straight line insulator; from the W.I. strap to the point B and from E to the centre of the transmission wire in the shackle insulator.

The ratio of dry to wet creeping surface under rain conditions is given, as this is interesting.

Shape of Insulator.—The shapes of standard insulators for the different voltages vary very greatly both between different manufacturers and between different standards made by the same manufacturer. This is no doubt due to different climatic and other conditions under which the insulators have to work. The shape and size of insulator working in sheltered inland places, for example, necessarily varies considerably from one required to work on the same voltage on a line near the coast, where it is exposed to heavy

TABLE II.—Straight-Line Insulators.

Nationality.	Approx. price.	No. of sheds.	Overall. Diameter.	Overall. Height.	Test voltage.	Arcing distance. Dry. A.B.C.D.	Arcing distance. Wet. E+C.D.	Ratio arcing distance Wet / Dry.	Insulator will arc at. Dry.	Insulator will arc at. Wet.	Factor of safety. Dry.	Factor of safety. Wet.	Creeping surface. Dry.	Creeping surface. Rain.	Creeping surface. Wet.	Ratio of dry creeping surface. Rain / Dry.	Volts per inch of dry creeping surface. Dry.	Volts per inch of dry creeping surface. Rain.	Minimum insulation to pin.	Volts per inch of insulation.
60,000 *volts*			in.	in.		in.	in.						in.	in.	in.				in.	
America (A)	—	3	14½	12½	150,000	—	9	—	—	116,000	—	1·76	—	—	—	—	—	—	—	—
„ (B)	21/7	4	14	12½	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ (C)	10/7	3	14	12½	—	14⅜	9¼	·627	158,000	108,500	2·63	1·81	37½	27	10½	·72	1,600	2,220	—	—
Sweden ...	7/6	3	10½	11½	100,000	11⅜	6⅝	·573	130,000	85,000	2·17	1·41	28½	19½	9	·684	2,100	3,080	1·25	43,000
Italy ...	5/10	3	11	12½	140,000	13½	7½	·55	145,000	90,500	2·42	1·51	37	27⅜	9⅜	·74	1,620	2,190	1·00	60,000
50,000 *volts.*																				
America (A)	—	3	14	11⅝	120,000	14	8½	·607	152,000	102,000	3·4	2·04	30½	21½	9	·705	1,650	2,330	1·20	41,600
Italy ...	4/8	3	10½	11¾	120,000	12⅜	6⅝	·532	138,000	85,000	2·76	1·70	35	26	9	·733	1,430	1,930	1·00	50,000
France ...	4/4	4	11⅝	10¼	—	12	7⅞	·658	134,000	96,000	2·68	1·92	33	25	8	·758	1,510	2,000	1·30	38,500
Germany ...	7/-	4	9	8	—	8⅛	4½	·554	98,000	63,000	1·96	1·26	24½	18⅝	5½	·76	2,040	2,690	1·00	50,000
40,000 *volts.*																				
America (A)	—	3	9½	7⅞	100,000	8½	5⅝	·632	102,000	73,000	2·55	1·83	19	13¾	5½	·723	2,100	2,910	—	—
„ (B)	10/4	2	9	8½	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
„ (C)	8/6	4	10	7¾	—	8¼	7¼	·878	100,000	90,500	2·5	2·26	38	32½	5½	·853	1,050	1,230	1·45	27,600
Sweden ...	2/6	3	7	8	70,000	7¾	4	·516	95,000	56,000	2·37	1·4	17⅝	11½	6½	·65	2,270	3,480	·90	44,400
Italy ...	3/9	3	9⅜	10½	100,000	11	5¾	·523	125,000	76,000	3·13	1·9	31⅜	23⅛	8¼	·738	1,275	1,730	·95	42,100
France ...	3/-	4	10⅜	9½	—	10⅝	6¾	·636	121,000	86,000	3·03	2·15	27⅞	20½	7¼	·738	1,440	1,950	1·20	3 300
Germany ...	7/10	3	8¼	8⅝	—	8½	4¾	·56	102,000	65,000	2·55	1·65	21¼	14¾	6½	·695	1,880	2,710	1·00	40,000
30,000 *volts.*																				
America (A)	—	3	8	6⅜	75,000	—	4⅝	—	—	64,000	—	2·13	—	—	—	—	—	—	—	—
Sweden ...	2/-	3	5⅝	6¼	60,000	6	3⅞	·64	79,000	55,000	2·63	1·83	13⅝	9⅜	4¼	·69	2,200	3.190	·87	34,500
Italy ...	2/9	3	9	8¼	80,000	9½	5½	·58	111,000	74,000	3·70	2·46	28½	21¼	7	·753	1,060	1,410	·75	40,000
France ...	2/1	3	9	8⅝	—	9½	5⅜	·568	110,000	73,000	3·70	2·45	20½	13½	7	·66	1,460	2,220	1·00	30,000
Germany ...	3/3	4	7½	6	—	5⅝	3½	·625	75,000	51 0.0	2·50	1·70	15	12	3	·8	2,000	3,500	·90	33,300
20,000 *volts.*																				
America (A)	—	3	5¾	3¾	50,000	—	2¾	—	—	40,000	—	2	—	—	—	—	—	—	—	—
„ (B)	3/-	3	5½	4¾	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sweden ...	1/6	3	4⅞	4¾	40,000	4⅝	2⅜	·52	63 000	34,000	3·15	1·7	10⅛	6⅝	3½	·65	1,975	3,080	·50	40,000
Italy ...	1/6	3	7	7	50,000	7¼	3¾	·517	90,000	53,500	4·5	2·67	22	16¾	5¼	·76	910	1,220	1·00	20,000
France ...	1/7	3	7⅛	7½	—	7⅝	4½	·57	96,000	63,000	4·8	3·15	17¼	11⅝	5⅝	·66	1,160	1,760	·87	23,000
Germany ...	1/9	4	5⅞	4⅝	—	4½	2¾	·61	63,000	40,500	3·15	2·02	12⅝	9⅝	2½	·80	1,610	2,020	·70	28,500
England ...	—	3	6⅝	8	—	7⅜	—	—	94,000	—	4·7	—	17¼	—	—	—	1,160	—	1·10	18,200
10,000 *volts.*																				
America (A)	—	2	4½	4⅛	40,000	4½	1¾	·39	63,000	25,000	6·3	2·5	8¼	5⅝	2⅞	·68	1,210	1,780	·50	20,000
„ (B)	2/5	2	5½	4¾	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sweden ...	0/9	2	4½	4 6/16	40,000	4½	2⅜	·58	63,000	38,000	6·3	3·8	8	5	3	·625	1,250	2,000	·50	20,000
Italy ...	0/10	3	5½	5¾	30,000	6	3¼	·54	79,000	46,000	7·9	4·6	17½	13	4½	·742	570	770	·46	21,700
France ...	0/10	3	5½	5¼	—	5⅝	2⅞	·538	73,000	42,000	7·3	4·2	10⅜	6½	3⅞	·626	960	1,540	·60	16,700
Germany ...	1/1	3	4¾	3⅞	—	3⅜	2	·533	44,000	28,000	4·4	2·8	9¼	6½	2⅜	·702	1,080	1,540	·50	20,000
England ...	3/1	3	7	7⅛	—	6⅝	4	·58	87,000	56,000	8·7	5·6	20¾	16½	4¼	·795	484	607	1·00	10,000
6,000 *volts.*																				
America (A)	—	2	3⅜	3	—	3¼	1¼	·385	47,500	17,500	7·9	2·92	6½	4¼	2¼	·654	923	1,410	·39	15,400
Sweden ...	-/5	2	3⅜	3	25,000	2⅝	1½	·575	38,000	21,000	6·33	3·50	4½	2½	2	·555	1,330	2,400	·25	24,000
Italy ...	-/8½	5	4¼	3⅝	30,000	4¼	2⅝	·613	59,500	38,000	9·9	6 3	11⅜	8¾	2⅝	·768	527	685	·60	10,000
France ...	-/8½	3	4⅜	4⅜	—	4⅝	2¼	·474	65,000	32,000	10·8	5·34	8⅞	5⅛	3⅜	·576	675	1.170	·60	10,000
England ...	1/10½	3	6⅜	5⅝	—	5½	3⅝	·675	74,000	52,000	12·3	8 66	13½	10½	3	·778	444	571	1·0	6,000
2,000 *volts.*																				
Italy ...	-/4	3	3⅜	3⅝	20,000	3½	1⅛	·322	50,000	16,000	25	8	7	4⅜	2⅝	·628	286	455	·30	6,670
France ...	-6½	3	3⅞	4⅜	—	4⅜	1⅝	·400	56,000	25,000	28	12·5	7⅜	4¼	3½	·55	358	470	·50	4,000
England ...	-/5½	2	4	4¼	—	4½	1½	·333	63,000	21,000	31·5	10·5	6½	3¼	3¼	·5	308	616	·60	3,330

gales and salt sea fogs. The difference in design is also due no doubt in some degree to the varying ideas of the expert engineers called in to design the line. Without unduly prolonging this article, it would be impossible to go into the question of these different designs, but some idea of them is obtained by the varying number of sheds, overall dimensions, and arcing and creeping distances given in the tables. It is worth while noting, however, that the shape of the insulator as well as its size has a considerable bearing on its efficiency when wet.

For example, in the 40,000-volt schedule the French insulator has a smaller factor of safety when dry than the Italian one, but a greater factor of safety when wet. The insulators are practically the same size, but the French one is better and cheaper. In the same schedule it will also be noted that the American C insulator has almost the same factor of safety when wet as when dry, whilst in the case of the Italian insulator the factor of safety wet is not much more than half that when dry.

The American insulator is a short stumpy one with four sheds, whilst the Italian insulator is a long one with three sheds and wide air spaces.

Shackle Insulators.—The difficulty of making really good shackle insulators is apparent from the tables. In every case the factor of safety is lower than for straight line insulators designed for the same voltage, and in the 10,000 and 20,000-volt schedules two of the insulators put forward by the makers appear to have no factor of safety at all. No shackle insulators appear to be made for pressures exceeding 30,000 volts, two or three insulators probably being used in series at higher voltages.

Sizes of Insulators.—It will be noted throughout the schedule that the German and Swedish insulators proposed as standards are smaller, and have a smaller factor of safety than the Italian or French ones. Can this be due to the fact that in Italy and the southern parts of France, warmer weather with more violent rain and thunderstorms are experienced than in the more northern and colder climate of Germany and Sweden, or is it merely a coincidence? Would not the accumulation of snow and ice, which would seem likely to take place on insulators and cross-arms in northern situations, counterbalance the effects of severe rain and thunderstorms in the south?

Factors of Safety at High Voltages.—At high voltages it

TABLE III.—Shackle Insulators.

Nationality.	Approx. price.	No. of sheds.	Overall. Diameter.	Overall. Height.	Test voltage.	Arcing distance. Dry. A B + B C	Arcing distance. Wet. B E or B C	Ratio arcing distance. Wet / Dry.	Insulator will arc at. Dry.	Insulator will arc at. Wet.	Factor of safety. Dry.	Factor of safety. Wet.	Creeping surface. Dry.	Creeping surface. Rain. Dry.	Creeping surface. Rain. Wet.	Ratio of dry creeping surface. Rain / Dry.	Volts per inch of dry creeping surface. Dry.	Volts per inch of dry creeping surface. Rain.	Minimum insulation to pin.	Volts per inch of insulation.
30,000 *volts.*			in.	in.		in.	in.						in.	in.	in.				in.	
America (A)	—	1	10¼	12⅝	90,000	—	4¼	—	—	59,500	—	1·98	—	—	—	—	—	—	—	—
Italy ...	4/6	3	7⅝	8½	60,000	5	2⅛	·425	68,000	30,000	2·27	1·0	10⅝	6⅞	3⅜	·65	2,810	4,360	1·25	24,000
England ...	6/9	3	7⅜	12	—	6½	2½	·385	83,500	36,000	2·73	1·2	13⅜	8⅛	5¼	·61	2,110	3,690	1·30	23,100
20,000 *volts.*																				
America (A)	—	1	8	8¼	60,000	—	2¼	—	—	32,000	—	1·6	—	—	—	—	—	—	—	—
Sweden ...	1/10	2	6	5½	40,000	3⅜	1½	·333	53,500	17,500	2·67	—	8¾	6½	2½	·74	2,290	3,080	·85	23,500
Italy ...	3/1	3	6¾	7	40,000	4½	1⅜	·412	60,000	25,000	3·0	1·25	10	6½	3½	·65	2,000	3,080	1·25	16,000
England ...	4/1½	3	7	10	—	5⅛	2⅜	·465	70,000	34,000	3·5	1·7	11½	6¾	4¾	·587	1,740	2,970	1·15	17,400
10,000 *volts.*																				
America (A)	—	1	5¾	6	40,000	—	1¼	—	—	17,000	—	1·7	—	—	—	—	—	—	—	—
Sweden ...	1/5	2	5	4⅜	40,000	3	¾	·30	44,000	13,000	4·4	1·3	6½	4½	2	·69	1,540	2,230	·6	16,700
Italy ...	1/4	2	5	4¾	30,000	3	½	·167	44,000	7,000	4·4	—	6½	3⅞	2⅜	·60	1,540	2,570	·6	16,700
England ...	—	2	5⅞	7¾	60,000	4¼	1⅝	·394	59,000	22,000	5·9	2·2	9	4½	4½	·50	1,110	2,220	·8	12,500
6,000 *volts.*																				
America (C)	-/9	1	4¼	4¼	—	2½	1⅛	·45	36,000	16,000	6	2·65	3½	1⅜	1⅜	·5	1,710	3,430	·75	8,000
Italy ...	-/10½	1	4⅜	3¼	—	2⅝	9/16	·224	43,000	7,500	7·17	1·25	5	2¾	2¼	·55	1,200	2,180	·60	10,000
2,000 *volts.*																				
England ...	-/9	2	4½	4	—	2¼	1	·45	30,000	6,000	15	3	4¾	3	1¾	·63	420	1,140	·8	2,500

TABLE IV.—Factors of Safety.

Straight Line Insulators under Rain at 45°.

Nationality.	60,000 v.	50,000 v.	40,000 v.	30,000 v.	20,000 v.	10,000 v.	6,000 v.	2,000 v.
America (A)	1·76	2·04	1·83	2·13	2·00	2·50	2·92	—
„ (B)	—	—	—	—	—	—	—	—
„ (C)	1·81	—	2·26	—	—	—	—	—
Sweden ...	1·41	—	1·40	1·83	1·70	3·80	3·50	—
Italy ...	1·51	1·70	1·90	2·46	2·67	4·60	6·33	8·0
France ...	—	1·92	2·15	2·45	3·15	4·20	5·34	12·50
Germany ...	—	1·26	1·65	1·70	2·02	2·80	—	—
England ...	—	—	—	—	—	5·60	8·66	10·50
Shackle Insulators under Rain at 45°.								
America (A)	—	—	—	1·98	1·60	1·70	—	—
„ (C)	—	—	—	—	—	—	2·65	—
Sweden ...	—	—	—	—	—	1·30	—	—
Italy ...	—	—	—	1·0	1·25	—	1·25	—
England ...	—	—	—	1·20	1·70	2·20	—	3

will be noted that these are in some cases very small, even when measured with rain falling at 45°, and there is no doubt but that this is due almost entirely to the difficulties in making large insulators. The design of very large insulators for the high voltages now in use abroad seems to be governed very largely by the difficulties of manufacture, theoretical considerations of electrical and mechanical strength having to become subservient to the capabilities of porcelain. The steady rise of factors of safety as voltages decrease is clearly indicated.

English Insulators.—In connection with English insulators, it is only fair to state that manufacturers up to the present have had many difficulties to face. In the first place, the use of insulators of this type in this country is comparatively new, and we are only getting our experience by degrees. In the second place, the number of insulators required is very much less than in foreign countries, where transmission is carried out over very much greater distances; and, thirdly, on account of the difference of ideas and lack of knowledge, the English manufacturer cannot be said to have been allowed to standardise his designs and sizes for different voltages. In spite of these disadvantages, large quantities of most excellent insulators have been turned out, and the writer, having been able to examine many insulators of foreign make, believes that, at any rate in such sizes as have been made up to date in this country, the English maker more than holds his own in excellence of design, workmanship, material and finish.

Earthing of Insulator Pins.—There seems to be considerable difference of opinion as to the advisability of earthing insulator pins, but it must not be overlooked that by earthing the pin, we materially decrease the safety of the insulator.

Figs. 4 and 5 will clearly indicate this. Fig. 4 represents an insulator mounted on a steel pin on a wooden cross-arm and wooden pole, and considering the pole itself to be a very fair insulator, we have the case of an electrified conductor, represented by the transmission wire, brought into

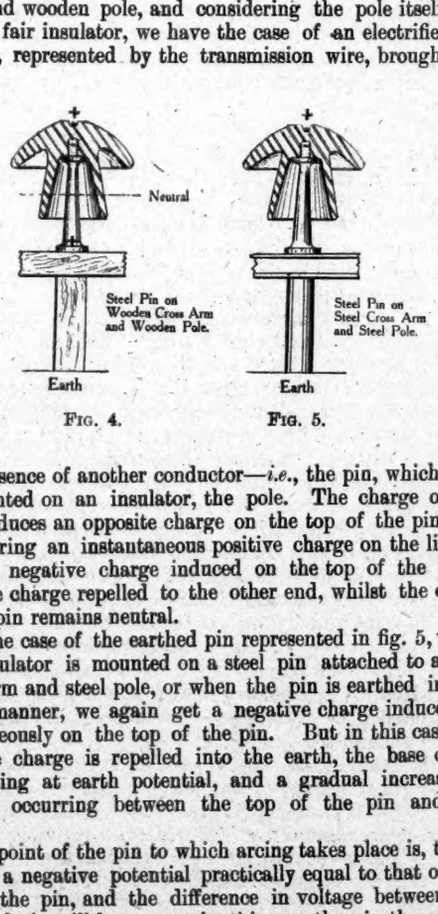


Fig. 4. Fig. 5.

the presence of another conductor—*i.e.*, the pin, which itself is mounted on an insulator, the pole. The charge on the line induces an opposite charge on the top of the pin, and considering an instantaneous positive charge on the line we have a negative charge induced on the top of the pin, a positive charge repelled to the other end, whilst the centre of the pin remains neutral.

In the case of the earthed pin represented in fig. 5, where the insulator is mounted on a steel pin attached to a steel cross-arm and steel pole, or when the pin is earthed in any other manner, we again get a negative charge induced instantaneously on the top of the pin. But in this case the positive charge is repelled into the earth, the base of the pole being at earth potential, and a gradual increase in voltage occurring between the top of the pin and the earth.

The point of the pin to which arcing takes place is, therefore, at a negative potential practically equal to that of the top of the pin, and the difference in voltage between the wire and pin will be greater in this case than in the case of the unearthed pin, when the P.D. will be less than between line and earth.

What the actual difference will be in the two cases it is impossible to say, but it will depend on several factors.

In the first place, the induced current in the pin will no doubt lag considerably behind that in the wire, the amount of lag depending on the size and shape of the pin and the magnetic quality of the iron of which it is made. The thickness of insulation between line and pin, its nature, and the method of earthing the pole will also have some bearing on this question.

In concluding these remarks the writer is well aware that many of them are open to considerable criticism, but it is with this end in view that the article has been written. The results obtained in the tests cannot, of course, be disputed, as they are actual facts, but it is in the interpretation of these results that opinions may, and probably will, differ, and it is by these different opinions and deductions that the sum of our knowledge is increased. The writer hopes at some time in the future to be able to pursue these experiments at high voltages and obtain better results.

THE ELECTRICAL TRADE WITH CANADA.

By ATHOL G. EVANS, Boston, U.S.A.

With reference to your leading article of January 24th, and the article in the issue of March 13th, perhaps a few supplementary remarks may not be out of place.

In the first place, I am inclined to think that Mr. Richard Grigg, Special Commissioner of the Advisory Committee to the Board of Trade on Commercial Intelligence, has by no means arrived at the true solution of the method for increasing British Trade with Canada.

In the case of electrical manufactures, the importation of finished articles into Canada would, in a great many cases, meet with very doubtful success. This applies particularly to electrical accessories, although not to the same extent to dynamos, motors, instruments and the like. As a matter of fact, however, the actual total value of accessories used would approach very nearly to the total value of the latter class of goods.

It is not only an established fact that the various types of electrical accessories used in Great Britain are almost unknown in Canada, and that Canadian practice follows absolutely the United States practice; but it is very doubtful, even if the customer's prejudice should be overcome by his patriotism, whether the Fire Insurance Associations and underwriters could be brought to hold the same view and pass some particular types of accessories.

The Fire Insurance underwriters' rules in Canada are on almost identical lines with the "National Electrical Code" in force in the United States, and they differ so very considerably from the Glasgow rules, that a manufacturer of apparatus under Glasgow rules would be at a material disadvantage compared with a manufacturer of apparatus under the United States "National Electrical Code." For instance, the distribution board or panel board manufactured under Glasgow rules with different poles on separate bushed bases, and an incombustible barrier between them, is materially different from the board manufactured in accordance with the "National Electrical Code," with both poles on the same base, three-quarters of an inch separation between metal of opposite polarity, and no barrier whatever.

The same thing applies to a certain extent to lampholders. The bayonet, or, as it is termed here, the Thomson-Houston lampholder, is almost unknown, having been superseded by the Edison screw-socket lampholder. Tumbler switches are also almost unknown, and although some of the better makes might pass the underwriters, it is certain that the majority of the cheaper varieties would not do so. The steel conduit and pressed steel conduit fittings of United States manufacture which have secured foothold in Canada are also so radically different from the British types that it would be impossible to work the two systems in conjunction.

All this taken in connection with the fact, as mentioned in the article of March 13th, "that the Canadian market, as a whole, reproduces the features of the United States and the close resemblance of the general conditions and habits of the people in the two countries has a considerable influence upon the circumstances of British and United States competition in the Canadian market," would point to the true solution not being importation into Canada of finished British manufactures.

The actual import duties on electrical goods into Canada are :—

British manufactured goods under Preferential Tariff, 15 per cent.

Intermediate Tariff, 25 per cent.

General Tariff (applied to goods manufactured in United States), 27½ per cent.

This means that the rebate given to British manufactured electrical goods is actually 2·5 per cent. of the import duty on United States manufactured electrical goods, as against the average of 30 per cent. rebate on other goods. This, however, is not sufficient to offset the material disadvantages under which the British manufacturer would be labouring. The fact that it takes as many weeks to obtain goods from Great Britain as it does days to obtain goods from the United States, is itself an almost insurmountable obstacle.

The only true solution to the problem seemed to be for a large British electrical company to establish a branch works in Canada as the large United States companies have already done. A considerable portion of the staff and workmen should necessarily have a thorough and intimate knowledge of U.S. practice in order to meet the U.S. manufacturer on his own ground. It would then be possible to manufacture accessories which are not used in Great Britain, but which are used in Canada and the United States, in competition with the U.S. manufacturer. The British manufacturer would then have the advantage of being able to import into Canada any finished or unfinished parts desirable, and at the same time take advantage of the preferential tariff. Further, he might advantageously import standard designs of dynamos, motors and instruments, such as he did not wish to manufacture in Canada. The import duty rebate would then afford him material advantages and enable him to compete with his U.S. rival, especially as the clauses against dumping in Canada would protect him in a manner in which he is not protected in Great Britain.

It certainly seems that the smaller manufacturers can entertain no hope of a successful invasion of the Canadian market, the only practicable plan being for a company with good financial resources to equip a works, and enter upon a well organised compaign.

There is one direction in which Canadian electrical industry will in the next few years make remarkable developments, and that is in large and small hydro-electric generating stations. One important point, however, must be borne in mind. The length of the Canadian winter in the East and Middle West may somewhat handicap this particular development, but on the Pacific side of the Rockies, where the winters are considerably milder, developments will certainly take place. With the vast water-power resources which the country possesses and the high price of coal and the rapidly growing price of lumber, it is only a question of a very short time before hydro-electric plants will become a matter of utmost necessity.

Havana Electric Railway Co., Ltd.—The report for 1907 states that the gross earnings of the railway and stage properties have amounted to $2,143,122, an increase of $224,019. The total net earnings were $924,951, from which must be deducted fixed charges $558,877, leaving $366,074, and after paying dividends amounting to 5½ per cent. on the preferred shares there remains a surplus of $91,074. According to the *Financial Times* the track mile earnings during the year were in excess of $36,000, indicating that the maximum earnings upon the present track mileage of the company are being approximated and that additional mileage will soon be required to handle properly the increased traffic incident to the normal growth of the city. In anticipation of this necessity the company has now pending before the proper authorities an application for the right to construct the additional trackage required, and favourable action upon this application is anticipated.

Belgium.—La Société Generale Belge d'Entreprises Electriques, of Brussels, reports a profit of £38,280 for the last financial year, out of which a dividend of £1 10s. per share is being declared.

The balance-sheet of La Compagnie d'Electricité de Seraing et Extensions shows a profit of £1,356 for the last financial year.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Heat Gauges for Hardening Tool Steel.

The device illustrated in the accompanying figures 1, 2 and 3 is an extremely ingenious one, based upon the fact that at the recalescence temperature, at which carbon steel should be hardened, it becomes non-magnetic. The instrument consists of a permanent magnet, with polar extensions of metal which remain magnetic at temperatures higher than the hardening temperature of carbon steels. A small object may be held upon the prongs of the gauge, over a vessel of brine, and heated by a blowpipe flame; when the correct temperature is attained, the piece to be hardened automatically slips off the gauge into the brine and is quenched. A piece of steel such as a tap, which requires hardening at one end only, may be placed *under* the gauge, with the end to be hardened

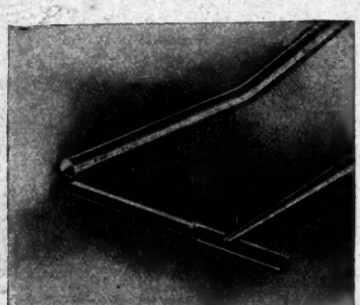


Fig. 1.—Tap in Position for Heating.

Fig. 2.—Tap Ready for Quenching.

under the pointed prong; this end is heated evenly until the correct temperature is reached, when it drops from the pointed prong, but remains hanging from the other one, ready for quenching. Pieces which cannot be uniformly heated in a blowpipe flame may be heated on a hearth, and tested with the gauge until they are found to be non-magnetic, when they should be promptly quenched. Tools thicker than ⅜ in. require a higher

Fig. 3.—Patent Heat Gauge.

temperature; these should be heated in a muffle furnace, fitted with a magnetic indicator on the same principle, which causes a bell to ring when the steel reaches the critical temperature. Brine is the best quenching liquid.

Messrs. Taylor, Taylor & Hobson, Ltd., of Stoughton Street Works, Leicester, who, with Mr. F. J. Mudford, of Arrow Works, Holloway, N., are the co-patentees, inform us that they have had the device in use for two years without a single waster through poor hardening, cracking or warping.

Messrs. Buck & Hickman, Ltd., 4, Whitechapel Road, E.C., are sole agents for the hand gauges for this country; the furnaces fitted with indicators are made by Messrs. Fletcher, Russell & Co., Ltd., of Warrington.

A Portable Cell Charger.

We illustrate herewith (fig. 4) a neat portable charging set manufactured by Electromotors, Ltd., of Openshaw, Manchester, for use in central stations for boosting up individual cells.

It consists of a low-voltage dynamo, direct driven by an ordinary semi-enclosed motor suitable for the service of the station. Both motor and dynamo are mounted on a substantial wrought-iron truck, which is provided with front swivelling wheels and with rubber tires throughout. An anchoring arrangement is also provided to lock the set in any position that may be desired. At the back end, mounted on a substantial angle-iron support, is a marble switchboard carrying a suitable D.P. switch and fuses and starter for the motor, and a shunt regulator for the dynamo, capable of varying its voltage from 0 up to 6, a voltmeter, an ammeter and a two-pin plug, with flexible cable for plugging-in at various points

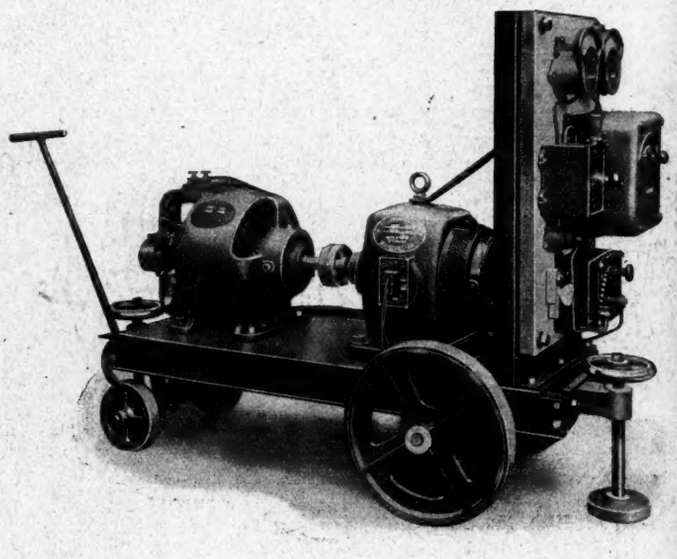


Fig. 4.—Portable Cell Charger.

in the station. The set can be provided with two lengths of low-tension cable and special clamps for gripping on to any of the cell terminals.

The whole arrangement is designed to occupy as little width as possible, in order to enable the set to pass between the rows of cells.

A New Trolley-Wire Safety Device.

A simple, cheap, but effective, device to ensure the immunity of the public from the danger of shocks due to contact with a broken live trolley wire has been provisionally protected (No. 3,912), and will shortly be placed on the market.

The device is shown in fig. 5, and consists of a brass member A, with tapped hole suitable for standard insulator, having at each end a spherical recess B. Into this recess, at either end, is hooked the knob, from which depends the ear to which the end of the trolley wire is fixed, the other end of the wire being secured in the same manner, so that the tension of the wire maintains contact.

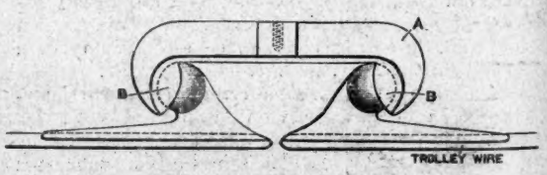


Fig. 5.—Trolley-Wire Safety Device.

A certain amount of sag or play of the wire is allowable while still maintaining contact, but should the wire break, the sag becomes excessive and the knob leaves the recess, the wires being thus rendered inert.

In cases where the distance between the supports is fixed, lengths of wire having the ears attached could be kept in readiness at the depôt, and in case of a break occurring, it would then suffice to bring along a line and hang it in place, instead of delaying traffic while repairing the break.

The patentees are Messrs. Joss & Green, of Waterloo, Liverpool, and full information can be obtained from Messrs. Coventry and Williams, patent agents, 9, Tempest Hey, Liverpool.

New Steam Trap.

With a view to overcoming the difficulties due to the use of superheated steam, Messrs Geipel & Lange, of 72a, St. Thomas Street, S.E., have recently introduced a new form of trap in which the valve is more durable and more easily got at to repair. Its durability, they say, is due, first of all, to the fact that the trap discharges in large quantities intermittently without dribbling, the opening being a large one, and consequently causing less surface friction against the mitre of the valve; secondly, that the valve is

Fig. 6.—Geipel Steam Trap.

of the rotating type, so that it tends to grind itself in at each discharge; and thirdly, that both the valve and the valve-seat are made of a nickel mixture, which is of a hard and tough nature, especially suited for superheated steam.

The accompanying illustration, fig. 6, will show how easily the valve is removed. It is merely necessary to unscrew the cover, when the valve, which is quite loose and disconnected, can at once be taken out and readily re-ground, while the seat is also easily renewed by means of a key.

These traps, although of the expansion type, will work over a considerable range of pressure—say, from 100 to 200 lb.—without adjustment, while the Admiralty type will work from atmosphere up to pressures as high as 400 lb. without any adjustment whatever.

Wall Panels.

We illustrate in fig. 7 a new form of panel which has recently been put on the market by Messrs. A. Reyrolle & Co., of Hebburn-on-Tyne, and which is being standardised by this firm for motor circuits in factories, collieries, &c. It will be seen that the complete panel embodies an oil switch, worked by a handle

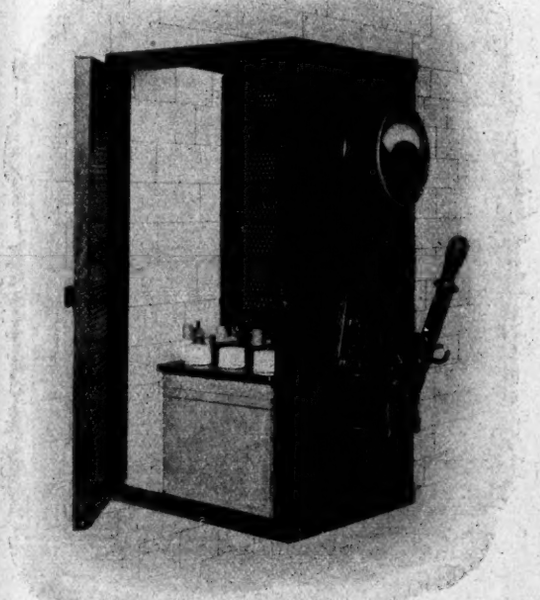


Fig. 7.—Motor Control Panel.

from the front, the live parts of which are fully protected by means of a perforated iron cage.

An ammeter is fitted in most cases, and a large number of combinations may be made up by adding a potential transformer for a voltmeter or lamp indicator, current transformers for overload trip, &c.

The framework consists of substantial angle-iron bar, and the whole apparatus has been carefully designed and made.

The "Bruston" Lampholder and Cap.

With a view to avoiding short-circuiting in lampholders and caps, Messrs. A. Vandam & Co., of 39, Victoria Street, S.W., have recently introduced what is claimed to be a considerable improvement over the ordinary type of fitting.

The "Bruston" patented arrangement, which is shown in section in fig. 8, is designed to entirely insulate the lamp terminals.

The leading-in wires pass into terminal blocks which are sunk in the porcelain interior of the lampholder, and attached to two

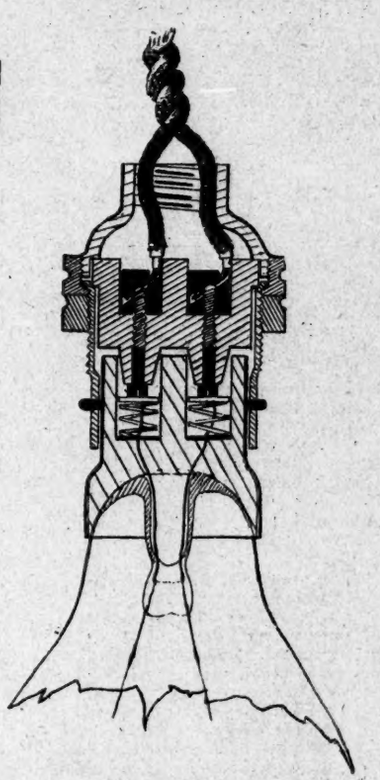


Fig. 8.—New Lampholder and Cap.

brass screws which project downwards and take the place of the normal plunger arrangement. The screws are fixed as to position, but they bed on movable terminals in the lamp-cap, which is preferably of porcelain. The insertion of the lamp in its holder results in the lamp terminals being forced downwards into their sockets, in which position both are completely enclosed in porcelain. The terminals in the lamp-cap are each supported by small springs; the terminals are also directly attached to the leading-out wires of the lamp. The arrangement lends itself to simplicity in detail, and is obviously safer to use when much vibration is met with.

We understand that the insulation resistance of these holders is extremely high; in fact, their good points constitute their only weakness, as their radical departure from standard design leads to lack of interchangeability.

Tantalum Lamp Fitting.

Messrs. Krupka & Jacoby, Watling Street, London, E.C., have put on the market an artistic fitting for use in conjunction with tantalum "Sun" lamps, which lends itself effectively to window decoration and lighting where high-class goods, such as jewellery, &c., require to be displayed to the best advantage. It is also suitable for the decorative lighting of hotels, restaurants, concert and banqueting halls, where festoon lighting can be most effectively used. The arrangement for wiring is simple, and wiring rosettes are supplied to cover the actual joints and give a pleasing finish to the festoon. The form of the fitting, which we illustrate, is such that the reflector portion closes up to the lamp bulb, showing no apparent join.

Fig. 9.

Tantalum Lamp Fitting.

New Limit Switch.

In the early days of electric lighting it was not unusual to supply at a fixed rate per lamp per annum, but there was no check on the consumer, and the arrangement was rarely satisfactory. Latterly the idea has come up again, in connection with a limiting device to prevent the customer from exceeding the agreed maximum.

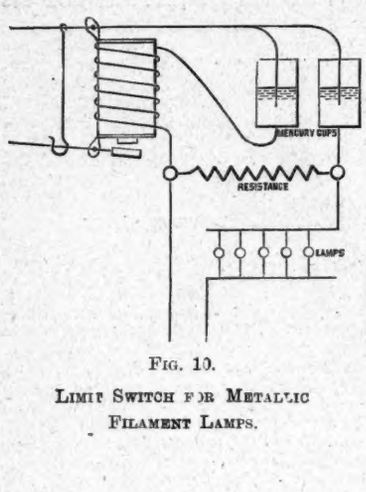


Fig. 10.

Limit Switch for Metallic Filament Lamps.

Several switches have been devised for the purpose; the one here described (patent No. 18,319, of 1907) is specially designed for use with metallic filament lamps. The cost of these switches is much lower than that of meters of corresponding capacities, and the maintenance charges are practically nil.

The ordinary type of limit switch is arranged to break the circuit when the maximum is exceeded, and is intended to keep making and breaking till the current is reduced by switching off some lights. This may answer with carbon filaments; but the metallic filament lamp takes a large momentary starting current, and consequently, when once a limit switch of this type is started with such lamps, it can only be stopped by switching off nearly all the lamps on the circuit. To get over this difficulty, and to avoid heavy sparking at the surface of the mercury contacts, a resistance is placed as a shunt across the main terminals of the switch in such a way that on breaking the circuit through the mercury cups the current takes the alternative path through the resistance; this causes the lamps to blink violently each time the circuit is broken, and not only draws the consumer's attention to the fact that he has exceeded his limit, but the blinking is so objectionable as to force him to get within his limit. As, however, the lamps are not extinguished, no excessive current flows round the magnet coil on again closing the circuit, and no troublesome sparking occurs in the mercury cups. The switch is substantially made and enclosed in an iron case; the upper part contains the switch itself, which is adjusted and sealed before sending out; the lower part, containing the terminals and two fixing screws, is sealed after connecting up and fixing in position on the consumer's premises. These switches have no time-lag, and consequently indicate the overload immediately on its occurring. They are made by the Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction.

BERGMANN ELECTROMOBILES.

We recently had the pleasure of a trial run in an electric automobile made in the works of the Bergmann Elektricitatswerke Aktiengesellschaft, of Berlin, for whom Messrs. Marples, Leach and Co., Ltd., are sole agents for this country. Messrs. Bergmann have taken up the manufacture of these vehicles in good earnest, and have a variety of standard types, ranging from private pleasure cars of several patterns, to heavy lorries, delivery vans, and so on.

The vehicle that we inspected was an electric brougham, such as we illustrate in fig. 1, and was an excellent specimen of carriage building; it was driven by a single motor, driving the back axle through toothed gearing, with a differential. The axle and gearing were of nickel steel, and roller bearings were provided. The controller gave five forward and two backward speeds, and there were brakes on both back wheels and on the motor shaft, in addition to the reversing of the controller in case of emergency. The maximum speed was about 15 m.p.h., and the distance travelled on one charge about 50 miles. The consumption of energy was stated to be 120 watt-hours per ton-mile. Instead of the single motor with gearing, two low-speed motors built into the back wheels can be supplied, and this construction is likely to advance in favour.

One of our illustrations, fig. 2, shows the chassis alone, in plan, while another gives a side view of it with the battery in position. It is interesting to note that the battery is of the Edison nickel-iron type, made by the German Edison Accumulator Co., which is controlled by Messrs. Bergmann. It consists of 64 cells, giving a normal discharge pressure of 80 volts, and is so disposed on the chassis that the cells are readily accessible for inspection and refilling with distilled water—the only attention that they require. The H 27 type, which is used on these vehicles, has a capacity of 175 ampere-hours, with a mean discharge pressure of 1·23 volts;

Fig. 1.—Electric Brougham Complete.

the normal charging current is 65 amperes, and the discharge 45 amperes. The cell can be fully charged in 3¾ hours, and weighs, complete with the caustic potash electrolyte, 18¾ lb. We are informed that the difficulties which were experienced in the early days of the Edison cell have now been completely overcome; beyond the usual precautions to ensure the use of a perfectly pure

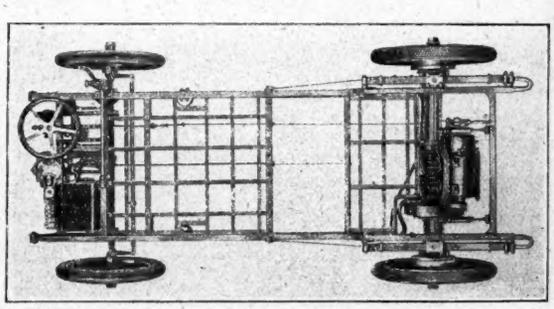


Fig. 2.—Plan of Chassis.

electrolyte, and to fill up with pure distilled water only, no special care is necessary—the cells can be left discharged, and charged or discharged at excessive rates, without the slightest injury, provided that the strong currents are not allowed to flow so long as to heat the cells.

It is probable that at no distant date the Bergmann electric vehicles will be a familiar sight in the London streets. Messrs. Marples, Leach & Co., whose business has developed enormously of late, are at the moment establishing themselves in a large and

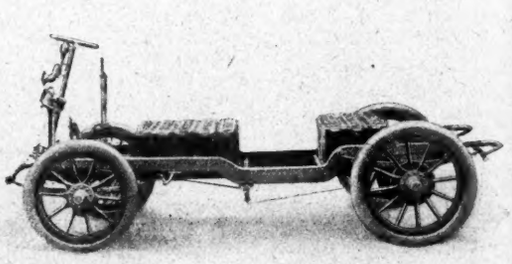


Fig. 3.—Chassis of Brougham Complete with Battery (Side View).

convenient building at 26-30, Artillery Lane, E.C., near their former premises, and may be trusted to give the vehicles every chance to prove their merits. On our trial run, the comfort and steadiness of the car were all that could be desired, and it showed itself perfectly amenable to control under all conditions of traffic.

NEW RADIO-TELEGRAPHIC PLANT AT THE EIFFEL TOWER.

Quite recently it was decided to construct a new radio-telegraphic station of considerable power at the Eiffel Tower, in order to replace the present post, which was erected three years ago, and was never anything but an experimental plant having at the most 20 or 25 H.P. at its disposal. For purposes of radio-telegraphy, it is recognised that in order to carry out signalling to great distances, it is necessary to have a sufficiently high tower from which to stretch the antenna. But the erection of a tower, even a few hundred feet high, involves considerable expense, and the towers which have been erected specially for the purpose are, therefore, limited in height. The Eiffel Tower, on the other hand, was erected for quite another purpose, and at a great outlay, and is no less than 300 metres (1,084 ft.) in height. Should it be equipped with apparatus which is in proportion to its height, or which, at any rate, will equal that which is now installed in some of the largest European stations, we may expect to see some striking results as to the distance which is covered, owing to the great increase in the height of the antenna. The installation of the new plant will, no doubt, mark an important advance in the field of radio-telegraphy. Signalling to America across the Atlantic is the least performance which we may expect; but it would be premature to say what results could be obtained, as this is the first time that such a high antenna will be used, together with a considerable amount of power.

The new plant will continue to be operated as a military post, and under the direction of the able engineer Captain Ferrié.

Although the complete plans have not been made public, we have obtained some information regarding the essential features of the plant, and these present some novelty, especially as regards

The Eiffel Tower, showing the Spread of the Proposed Aerial Wires.

the construction of the station itself. Instead of the usual buildings which we find in other plants, it has been decided to construct an underground station which will lie under the park of the Champ de Mars at the base of the tower, and will be quite invisible from the surface. There were two reasons which led to the adoption of this idea. One of these was that the explosion due to the induction coil spark made a loud report resembling a pistol shot, and this could be heard quite distinctly in the surrounding residences, causing some inconvenience. With the proposed high-power apparatus the noise will be very much greater, which led the designers to favour the underground station, as in this case nothing will be heard from the outside. The second reason lay in the fact that the sounds given by the sparks would allow an outsider, who was an experienced operator, to read the messages by sound. Especially in time of war, when the messages are to be kept as secret as possible, this would be a great drawback. Accordingly there will be built an underground chamber of large size, lined and vaulted with masonry and well lighted by electric light. Here will be placed all the apparatus of the station; which will probably include the new electrolytic detector invented by Capt. Ferrié, which has already shown excellent results in practice.

As regards the form of antenna which is to be used, this will consist of a set of wires fixed at the top of the tower and spread out towards the ground. The plans call for four principal wires which form the main part of the antenna. In the accompanying engraving will be noticed the maximum spread which is to be given to the antenna, indicated by the dotted lines. The antenna will be reinforced by a series of cross-wires which will join the principal wires, according to the most modern methods. The four main wires will be brought down to the ground, and anchored in suitable masonry pillars several yards high, through the middle of which will pass the wire leading to the ground. In this way the wires will be kept out of reach of the public which frequent the park around the base of the tower.

For a long time it has been proposed to erect a high-power station which would take advantage of the height of the tower, but the matter was retarded owing to the fact that the different authorities could not come to an agreement, also the necessary credit had to be obtained, seeing that the erection of the plant will involve a considerable expense. It is fortunate, therefore, that all the difficulties have now been removed, so that the plans can be carried out without delay.

Book Notices.—*Jubilee of the Allgemeine Electricity Co.*—The present year witnesses the celebration of the twenty-fifth year of the existence of the Allgemeine Elektricitäts Gesellschaft, of Berlin, which, from a modest beginning, has geographically extended itself directly or indirectly into many parts of the world, and has become a contracting and financing undertaking on a very comprehensive scale. According to a jubilee celebration work which has just been issued, the history of the enterprise started in connection with the International Electrical Exhibition held in Paris in 1881, when Herr Emil Rathenau decided to develop the Edison system of incandescent lighting, and the Edison Co. was formed in Berlin in 1883, to utilise the Edison patents and to sell electrical machinery, apparatus, &c., the share capital being £250,000. In 1884 the company concluded an agreement with the city of Berlin, authorising the establishment of generating stations and the laying of cables in the streets for the purposes of electrical distribution. A special undertaking, which subsequently became the present Berlin Electricity Works Co., was constituted for working the concession, which was provisionally fixed at 30 years. The right of utilising the Edison patents was, in 1887, converted into the possession of these patents, the company's share capital being increased to £600,000 to effect the purchase, and the name was transformed into the existing title of the Allgemeine Co. The scope of the undertaking was then enlarged so as to include the installation of electric tramways, the development of electro-chemical undertakings, the construction of dynamos and motors, the manufacture of conductors and insulators, &c., so that the company produced everything requisite for electric lighting and power work. In addition to establishing central stations in different parts of the world, the company became associated with the Electro-Chemical Co., of Bitterfeld and Rheinfelden, and absorbed the Union Electricity (Thomson-Houston) Co. in 1903; it also participated in the Brown-Boveri Co., and concluded a community of interests with the New York General Electric Co. In the course of time this geographical expansion of the A.E.G. strengthened its contracting character, and the Electricity Supply Co. was formed in 1897 to establish, acquire and work lighting and power stations, whilst the Bank for Electrical Enterprises, of Zurich, was constituted with the aid of the Deutsche Bank and the Swiss Credit Anstalt to facilitate the financing of undertakings abroad. Apart from loan capital, the company now has an ordinary share capital of £5,000,000, has 45 branches in Germany, 85 independent companies and offices abroad, and 40 representatives in cities outside of Europe, whilst the number of persons employed in Europe exceeded 30,000 on June 30th, 1907.

The souvenir volume which has been issued to commemorate the anniversary is a magnificent production, consisting of a moderate proportion of text, and a complete collection of reproductions of admirable photographs showing the company's offices and works. The latter include factories for the manufacture of incandescent and Nernst lamps, arc lamps, meters, instruments, switchboards, generators and motors, locomotives, turbines, wire and cable and automobiles—truly a worthy souvenir of a splendid record of progress, showing abounding prosperity and excellent organisation. Not the least notable feature of the illustrations is the well-to-do appearance of the workers, many of whom are women; the orderly arrangement of the shops and of the work in hand is also noteworthy. The volume measures roughly 12 × 15 × 2 in.—dimensions which speak for themselves as to the thoroughness with which the work has been performed; and the front cover is adorned with an aluminium plate representing an eagle, with a background of workshops and chimneys.

"Questions and Answers in Electrical Engineering." By A. E. Moore and F. Shaw. London: Longmans, Green & Co. 1908. Price 2s. 6d.

We have received from Mr. Arthur F. Bird, of 22, Bedford Street, Strand, a copy of the April wireless telegraphy number of the *Electrician and Mechanic*, an American monthly magazine (8d.).

We have received from the *Electrical Times*, Ltd., a copy of their annual reprint of tables of costs and records for 1906-7, of electric supply and tramway undertakings. A wide margin is left for making one's own notes, and a special paper is employed which will take writing ink.

"Electricity: What is It?" By W. D. Verschoyle. London: Swan, Sonnenschein & Co., Ltd. 1908. Price 2s. 6d. net.

"The Evolution of Forces." By G. le Bon. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1908. Price 5s.

EXPIRING PATENTS.

(Concluded from page 724.)

21,045. "Dynamo-electric machines." M. Hutin and M. Leblanc. November 2nd, 1894. Describes devices for maintaining synchronism in alternate-current machines. One method consists in the connection of a condenser or battery in shunt between the terminals of the inducing circuit of the machine. The other consists in the provision on the axis of the synchronous machine of an asynchronous machine for the same number of poles. In a particular case a synchronous motor with a Paccinotti armature is provided with a cylinder of damping coils, and is connected to the stator of an asynchronous motor having a squirrel cage rotor.

21,827. "Dynamos." J. Imray. November 12th, 1894. Describes the construction of self-exciting alternate-current dynamos, the excitation being obtained by the use of condensers. In the machine described the armature consists of a stationary ring carrying an even number of small cores surrounded by windings, whilst the revolving field is of the nature of a squirrel cage armature. The condenser is connected across the terminals of the coils of the poles of this armature, which coils are all in series. Where polyphase current is required for excitation this is said to be obtained by the use of inductive resistances in conjunction with the condenser.

22,451. "Registering or integrating apparatus." F. N. Connet and W. W. Jackson, both of Rhode Island, U.S.A. November 20th, 1894. The apparatus described is more particularly for application to a convenient form of the water meter forming the subject of a prior patent. It is, however, applicable to various fluid and electric meters, and generally to the determination of quantity of flow where such is a function of force produced by the flow. A cylinder is rotated uniformly by clockwork or otherwise, upon whose surface there is a raised and depressed portion, the line of demarcation being a curve determined empirically or by calculation according to the relation between the quantity and force. For example, in the application to the water meter above referred to the ordinates vary with the differences of pressure in the open and contracted part of the main, while the abscissæ represent the quantity of water flowing during one rotation of the cylinder.

24,541. "Electrolysis." C. Kellner, Vienna. December 17th, 1894. Relates to using moving mercury cathodes. In one example the apparatus is arranged for electrolysing common salt to obtain alkali and chlorine. It consists of an iron vessel within which is a porcelain or like cylinder having numerous helical channels through which a stream of mercury flows. One set of the helical channels are inside the cylinder, and the other set are outside, openings in the cylinder allowing the mercury to flow from an inside channel to a corresponding outside channel right through the core. Within the porcelain cylinder is arranged a suitable cylindrical anode within which salt is placed and passes below the anode to form the electrolyte solution outside. The iron vessel contains water charged into it through a suitable opening. The mercury is connected at several points by wires to the iron vessel, and the latter by a wire to the negative pole of the dynamo, &c. On passing a current, which is preferably of high tension, chlorine is evolved at the anode, and is collected while sodium amalgam forms and passes to the outside of the cylinder, where it is decomposed by the water, liberating hydrogen which passes out through an outlet and strong caustic liquor which is led off through a second outlet. The mercury flowing from the lowest channel passes through a tube at the bottom of the apparatus and is forced by a pump through another tube back to the top-most inner channel for re-use. By placing a solution of sodium nitrate in the iron vessel, ammonia is liberated therein instead of hydrogen. The current formed by the decomposition of the amalgam may be led off for electrolysing, or for other purposes, by suitable connections. In a modification, the anode is formed as a flat plate, with communicating inclined channels on each side. In a further modification, specially arranged for large operations, the so-called "forming" cell is separate from the electrolytic cell, the channels in the two communicating by tubes each provided with a bend. The channels within both chambers are free from the sides of the vessel so as to be subjected to action on both right and left instead of on one side only. If desired, a resistance may be inserted in the circuit to form a short-circuit element which promotes the formation of caustic soda in the forming vessel.

24,876. "Electric winding mechanism." H. Aron, Berlin. December 21st, 1894. An armature attached to a spring oscillates between the curved pole-pieces of an electro-magnet automatically circuited, and the winding shaft is driven by a pawl and ratchet. The current runs from the electro-magnet through a pin on the armature, and one prong of a fork is pivoted in unstable equilibrium assisted by a spring. When the fork has passed the dead centre with the armature, its other prong, which is insulated, becomes applied to a pin and the circuit is thereby broken. The armature then completes the stroke by its momentum, and is returned by the attached spring. This mechanism serves to wind up a clock mainspring, a spring motor, and is specially suitable for electric meters with clocks.

25,048. "Attachments for electric mains." G. H. Nisbett, Liverpool. December 24th, 1894. Lead-armoured cables are connected to junction boxes, wall and ceiling roses, cut-outs, couplings and lamp-holders by soldering, &c., the case of the cable to a metal ring inside the case, or to the case itself, if of metal, or by corrugating a metal sleeve on to the outside of the conductor. A metallic connection is made between the two ends of the sheathing, and the chamber in the base or case may be filled with insulating material.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

8,133. "Improvements in fixing commutators for dynamo-electric machines or other bodies to their supports." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. April 13th. (Complete.)

8,135. "Telephotographic apparatus." P. Berjonneau. April 13th.

8,148. "Electric foot-warmer." O. Krueger. April 13th. (Complete.)

8,176. "Improvement in antiseptic coverings for mouthpieces of telephones and speaking tubes." W. C. Latham. April 13th.

8,190. "Improvements in interrupters for electrical ignition." The firm Robert Bosch. (Date applied for under Sec. 91 of the Act, March 23rd, 1908, being date of application in Germany.) April 13th. (Complete.)

8,206. "Improvements relating to electrical devices for the measurement of speeds." Elektrizitäts Ges. Alioth. (Date applied for under Sec. 91 of the Act, May 2nd, 1907, being date of application in Germany.) April 13th. (Complete.)

8,209. "Improvements in or relating to the process of manufacturing certain electric appliances and apparatus therefor and for other purposes." C. O. Bastian. April 13th.

8,210. "Ear instrument with diaphragm, which can be kept electrically vibrating, but open to direct sounds while in use by the deaf." W. H. Warn. April 13th.

8,253. "Electric arc lamp, lens and screen for theatrical stage effects." G. A. Applebee. April 14th.

8,266. "Improvements in or connected with means for ascertaining the magnetic bearings of a distant object." Booth & Brooks, Ltd., J. W. Booth and W. Brooks. April 14th.

8,277. "Improvements in or relating to the production of high-frequency electrical oscillations." O. Scheller. (Date applied for under Sec. 91 of the Act, August 13th, 1907, being date of application in Germany.) April 14th. (Complete.)

8,283. "Improvements in and relating to electric switches." F. H. Smith. April 14th.

8,288. "Improvements in or relating to differential relays." Felten and Guilleaume-Lahmeyerwerke Akt.-Ges. (Date applied for under Sec. 91 of the Act, May 4th, 1907, being date of application in Germany.) April 14th. (Complete.)

8,289. "Circuit tester, fault and spark locater for electrical circuits of induction coils and the like." A. E. Lamkin, E. T. Crofts and K. Beazley. April 14th.

8,298. "Improvements in choking-coils for use with arc lamps." L. O. Langworthy. April 14th. (Complete.)

8,300. "Improvements in or relating to telegraphy." F. G. Creed and W. A. Coulson. April 14th. (Complete.)

8,308. "Improvements in electric arc lamps." W. J. Davy. April 14th.

8,346. "Improvements in controllable electric motors receiving and transmitting impulses which may be used for gun fire control." H. J. Creffield. April 15th.

8,375. "Improvements in electric arc lamps." A. D. Jones. April 15th.

8,377. "Improvements relating to alternating electric current distribution systems." J. S. Peck. April 15th.

8,414. "Improvements in and relating to alternating-current motors of the commutator type." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, April 17th, 1907, being date of application in Germany.) April 15th. (Complete.)

8,415. "Improvements in and relating to dynamo-electric machines." J. E. Noeggerath. (Date applied for under Sec. 91 of the Act, April 25th, 1907, being date of application in United States.) April 15th. (Complete.)

8,416. "Improvements in and relating to incandescent filaments for electric incandescent lamps." Wolfram-Lampen Akt-Ges. (Date applied for under Sec. 91 of the Act, 1901, April 26th, 1907, being date of application in Germany.) April 15th. (Complete.)

8,421. "Improvements relating to incandescent filaments for electric incandescent lamps." Wolfram-Lampen Akt-Ges. (Date applied for under Sec. 91 of the Act, May 13th, 1907, being date of application in Germany.) April 15th. (Complete.)

8,429. "Improved method of preventing the corrosion of the internal parts of boilers due to electro-chemical action." P. E. G. Cumberland. (Date applied for under Rule 13, June 10th, 1907. An invention comprised in application No. 13,417 dated June 10th, 1907.) April 15th. (Complete.)

8,435. "Improvements relating to the production of electrical discharge." W. E. Evans. (Elektrochemische Werke, Germany.) April 15th. (Complete.)

8,449. "Improved sunk-switch box and cover for electric light." W. Todd. April 16th.

8,467. "Improved arrangement of driving and braking gear for overhead electric cranes." A. Jack. April 16th.

8,471. "Improvements connected with certain kinds of electric heating apparatus." Verity, Ltd., and H. S. Smith. April 16th. (Complete.)

8,479. "Improvements in magnetically operated ignition plugs for internal combustion engines." C. W. Higgs and W. W. Stanton. April 16th.

8,481. "Improvements in and relating to electric contact makers, distributors and the like." A. G. Benstead. April 16th.

8,494. "Improvements in luminous electric signs, letters, or figures for advertising or ornamental purposes." E. V. Gratze. April 16th.

8,521. "Improvements relating to alternating electric current distribution systems." G. North and J. S. Peck. April 16th.

8,532. "Improvements in turbo-electric generator systems." E. J. Berg. Date applied for under Sec. 91 of the Act, April 20th, 1907, being date of application in United States.) April 16th. (Complete.)

8,523. "Re-inforced concrete pole or mast for supporting electric conductors or for other purposes." H. W. Oberlies. April 16th. (Complete.)

8,543. "Improved system of fixing electric punkahs." A. Bergtheil. April 16th.

8,547. "Improvements in field magnets for magnetic inductors." H. Ruthardt. (Date applied for under Sec. 91 of the Act, April 16th, 1907, being date of application in Germany.) April 16th. (Complete.)

8,558. "Electric order and alarm apparatus." J. J. F. Dickmann. April 16th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1906.

Exciting Ruhmkorff and other Electric Coils. Sir O. J. Lodge, Kt. 29,086. December 20th.

1907.

Dynamo-Electric Machines. Johnson-Lundell Electric Traction Co. (R. Lundell, United States.) 6,847. March 21st.

Automatic Time Controller for Targets, Cameras, Electric Signs and the like. E. C. Burnup and M. Kirk. 6,869. March 22nd.

Electric Transmission of Power from a Prime Mover for Automobiles and other Purposes. R. D. Archibald. 7,933. April 5th.

Controlling Devices for Electric Motors. British Thomson-Houston Co. (General Electric Co., United States.) 8 764. April 15th.

Electric Switches. P. Watson. 9,652. April 25th.

Voltage Regulators. S. B. Storer. 9,683. April 25th.

Electrically-Operated Signals. British Thomson-Houston Co. (General Electric Co., United States.) 9,969. April 29th.

Microphones for Telephones. R. C. Browne. 11,440. May 4th.

Control of Electric Motors for Driving Rolling Mills. Allgemeine Elektricitäts Ges. 11,594. May 17th. (Date applied for under International Convention, May 21st, 1906.)

Inductive Telegraphy and Telephony. L. Maiche. 12,529. May 30th. (Date applied for under International Convention, May 30th, 1906.)

Sparking Plugs for Internal-Combustion Engines. R. Carpentier. 12,539. May 30th.

Folding Electric Light Bath Cabinet. C. M. Holmquist. 15,505. July 5th.

Automatically-Operated Station Indicators for Electric Railways. M. Daley and P. Daley. 15,636. July 8th.

Mechanism for Operating and Controlling the Ignition of Internal-Combustion Engines. A. C. Mather. 17,163. July 26th.

Space Telegraphy. J. S. Stone. 17,690. August 2nd. (Date applied for under International Convention, August 3rd, 1906.)

Receivers for Wireless Telegraphy. S. Eisenstein. 19,274. August 27th.